British Society for the Study of Orthodontics 1935

TRANSACTIONS
OF THE
BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS
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By A. L. Packham, M.R.C.S., L.R.C.P., L.D.S.

SOME OBSERVATIONS ON ORTHODONTIC PRACTICE.

Two thoughts are uppermost in my mind at this moment. I am eager to return thanks to you most sincerely for the honour you have conferred in electing me as your president for the coming year, and I am just as eager to express my sense of my inadequacy to fill such an important position. I will, however, with your support, endeavour to carry out the duties and maintain the dignity of the Chair to the very best of my ability. Apart from the fact that it has been my privilege to serve the Society upon the council for some few years, there is little reason for me to be standing here this evening, and to be wearing the badge of office presented in 1928 by Mr. Maxwell Stephens, then president.

I have experienced considerable difficulty in selecting material upon which to address you. I am really sorry that I have nothing new and original to offer ; but if you will glance at the programmes which you have received, it will be apparent that we may expect a season full of most interesting and stimulating work. After consideration it appeared that it might be possible for me to help forward the work of the Society, if only to a small degree, by giving some observations upon orthodontic work during several years of hospital and general practice. I shall try to keep your interest and make my point clear without the aid of slides.

The appeal which the subject of orthodontics makes is world-wide, and it is interesting, and indeed arresting, to contemplate the amount of time and thought which is devoted to it. An immense amount of energy has been shown, and will continue to be shown, in the elucidation of its problems.

Orthodontics is a branch of dental surgery, which again is a speciality in the parent body of medicine. The incidence of and suffering produced by malocclusion of the teeth are far less than in the case of either caries or periodontal disease. Yet, in this city alone, two societies exist to study orthodontics ; there are several societies on the Continent with the same object in view. There is a Japanese orthodontic society, whilst in America there are many societies and schools all again devoted to it. Further, there have been two very successful International Orthodontic Congresses where men have met, being drawn together from almost all parts of the globe ; and there are journals devoted exclusively to its literature. The report of the second International Orthodontic Congress is a tome in itself, and from a perusal of this book it might well be thought that everything that could be said has been said upon the subject.

Orthodontics is concerned with the straightening of the teeth, but in order to do this intelligently a knowledge of the metabolism and growth of bone (and particularly of the bones of the skull and lower face) is necessary, together with the method in which these bones should develop from infancy to maturity.

The difficulties surrounding our speciality are, to the general dental practitioner at least, very great ; and personally I would

have sympathy with the busy practitioner who endeavoured to limit his orthodontic work to the minimum. Yet the average Englishman still desires to have his dental surgeon carry out all the work in his mouth or his children's mouths which may be necessary. The age of specialisation has not yet arrived in this country ; whether it will come in due course is a debatable point, and opinion is divided as to whether it is wholly desirable. Dental surgery is a very personal matter ; English people are conservative by nature, and a suggestion that the case should be handed over to some other practitioner is not welcomed. At the present moment I think the fact remains that the average man must be prepared to undertake orthodontic work, or anticipate losing some general practice as well. No wonder, then, that this Society, which exists to study this difficult subject, should be so well supported. I have sometimes thought that as putting is to golf, so is orthodontics to dental surgery : on some (and rare) occasions the hole is as big as a bucket, and the ball will not stay out ; on others, nothing is more difficult than to get the ball to creep near the tin. In like manner, some cases will be successful with the merest push, others refuse to improve despite our best and most ardent endeavours. And just as one cannot assign a reason for the one failure, neither can a reason be clearly shown for the other. I feel that an evening devoted to a discussion upon orthodontic failures would be as fruitful to our knowledge as the many and excellent successes which are brought forward for consideration. A careful analysis of the factors at work would be of great benefit, and might well throw some light on cases which are baffling and difficult ; negative results are often as illuminating as positive ones, in the field of research. However, human nature is very strong, and we all like to report our successes. Nevertheless, it is my hope that we may be able to have an evening during the year when we may consider some material upon these lines. The ætiology of malocclusion is by no means settled, and he would be a bold man who could assign a cause to many of the cases which come under notice. Very many of us listened with the greatest interest to Mr. H. Chapman's presidential address in 1926, in which he gave the detailed histories of twenty-nine members of twelve families, some of the members of which were normal, the majority showing varying degrees of malocclusion. It was a most valuable piece of work. Of the many present on that occasion, some must have been listening carefully and eagerly for some common factor which would emerge from the great mass of detailed information. Mr. Chapman said (I am misquoting from his paper, but by his permission) : " In the cases recorded in ' Orthodontics : Investigations in Ætiology,' *Trans. B.S.S.O.*, 1925, all the recognised causes (or nearly all of them) have been operative, singly or otherwise, in one case or another ; but it can be proved, directly or indirectly, by one or more of the cases, that any particular cause has not had the effect usually assigned to it, e.g. the case of a boy (No. 870, Family No. 2) whose feeding was entirely artificial from birth and during the first year (the diet consisted of Nestlés milk, barley water and lime water), who also slept with

his mouth open (breathing by day not noticed), and whose tonsils and adenoids were removed at age 8 years, but who yet had normal occlusion." And again, " The conclusion to be drawn, which seems to be irresistible from the evidence, is that the major causes of malocclusion are probably ante-natal, e.g. heredity and parental health, and that post-natal causes are of secondary importance even if they have any effect at all."

If this statement be true, and personally I have little doubt of its truth, then preventive medicine, so far as orthodontics is concerned, is in an almost impossible position. Very little, it appears, can be done, beyond urging the importance of perfect general and dental health upon the prospective parents, together with everything that can be done to promote good post-natal development of the child. It is, I think, regrettable that more has not been done on the lines worked out by Mr. Chapman. It needs great care, much trouble and perseverance, but the result would be a real contribution to our knowledge. Moreover, it is well within the scope of any member of this Society. Personally, I feel that more research on what might be called clinical lines is really urgently called for, not only in the field of orthodontics but in general dental surgery as well.

Now if the causation of malocclusion be so complex, diagnosis and treatment may be expected to follow in its footsteps, and they do. Is the lack or overgrowth of bone with which we are presented ante- or post-natal in origin ? Can we do anything to stimulate the flagging growth of bone in either a vertical or a horizontal plane. In many cases we know that this growth is very successfully stimulated by force correctly and carefully applied at the right time. In many other cases this growth starts off by itself, as it were, without any stimulus from the orthodontist. In other words, cases seem to right themselves. Incidentally, a good deal of kudos is supplied and, I may say, gratefully received from this fact. Lack of growth in the vertical plane, namely close-bite, is a feature which I find very difficult. One feels it must be due to this lack of growth of the alveolar bone, so that the teeth do not receive the necessary support to allow them to rise and descend respectively. This condition is rarely seen by itself, but very much more commonly in conjunction with some other abnormality, and nearly always when the mandible is in an abnormally posterior position, and the arches are of a narrow or V-shaped type ; that is in the cases we know as Angle's Class II, Divisions 1 and 2. In Division 1 cases, the degree of close-bite as evidenced by the overlap of the incisors may be as much as one-eighth of an inch, whilst in Division 2, the lower anterior teeth may be completely hidden by the uppers when the teeth are in occlusion, thus giving a measurement of one-quarter inch lack of bone growth in a vertical direction. The latter condition may often be tentatively diagnosed by observing a dipping in, or pucker, of the lower lip when at rest in apposition with the upper one.

May I digress here for a moment, to lay stress upon the importance of observing the physical features in any orthodontic case. Height and weight in proportion to the age of the child : the state

of development of the long bones of the body, in addition to an even more detailed examination of the skull and lower face—both full and profile—will often give valuable hints. Diagnosis can be aided or modified by such an examination, often to a marked degree. It is, I think, a good habit to acquire, in that it puts things in their right order. If the child's face is reasonably well-developed, the chin not receding, and above all if the lips fall together naturally and easily when in repose, then orthodontic treatment is rarely necessary.

Close-bite, or vertical under-development, rarely tends to cure itself and is, in my opinion, the critical and central feature in an orthodontic case. It is not always associated with a receding chin, for it occurs in those not uncommon cases of Class 2, Division 2, where the chin is often in its correct position. Indeed it is often here most marked. The association of close-bite with a postnormal position of the mandible, i.e. when the chin is seen to be of a receding type, is very interesting and also arresting. The two are so very often seen together. One is left to wonder which precedes the other : does the abnormal position of the bone cause a vertical under-development of the tooth-bearing alveolus ? Is it the mandible only in which this under-development occurs, or is there vertical lack of growth in the maxilla as well ? Does the lack of growth vertically lessen the tendency for the lower jaw to develop in a horizontal direction, and so come " forward " (as we say) into its correct position. Speaking for myself, I find it a great mystery, and so far as I know, no really adequate answers to these questions have so far been given. And here I feel compelled to say that despite a very great deal of most highly skilled and invaluable work done by Sir A. Keith, Professor Brash, Mr. Wilson Charles and others, there is little definite information which busy practitioners can take home and digest with gusto, and subsequently apply with keen pleasure. Please do not mistake me—I am not in the least degree critical of the really wonderful research that is going on ; all I wish to do is to emphasise some of the difficulties which underlie our work.

The practical man, however, says: " It appears that I can do little in the way of preventive orthodontics. Let me tackle as best I can the case in hand. What is the use of worrying about the cause ? Let me get on with the treatment." But without a knowledge of ætiology how can a sound diagnosis and prognosis be arrived at ? Prognosis is a very important factor in all medical work. The constant and most justifiable questions which parents ask are : " How long will the treatment last, and what are the prospects of success ? Are you reasonably certain, or merely hopeful, of getting a result which can be described as satisfactory ? " Those questions I am loathe to answer unequivocally.

Apart from what I may call the post-natal accidental cases, such as thumb-sucking and an upper incisor caught inside the bite our problem is an under-development of the bones of the lower face, either in a vertical or horizontal plane, or both. Indeed, if only the jaws be developed enough, the reciprocal pressures of the muscles upon the outer and inner aspects of the arch will of them-

selves align the teeth correctly. It seems to me that treatment can be directed in one of two ways. We can stimulate bone to grow, by such things as will stimulate all the bones of the body, e.g. free and vigorous function, attention to general health, vitamins, fresh air, good and healthy surroundings, U.V. light, etc. Something can be done in this way, and possibly we might attend to this aspect more than we do, for after all, jaw bones are not different in their essential mode of development and metabolism from other bones in the body ; this is a point upon which too much emphasis can scarcely be laid. Secondly, we may use gentle and continuous pressure to induce this desired growth. The exercise of the muscles of the face which pull on the body of the maxilla and mandible is, I believe, very important, and I would wish to remind you of the rationality of this method of treatment, and to congratulate our colleague, Dr. Rogers of Boston, on his careful work upon this aspect. This work appeals to the mind as common sense ; it also has the advantage of being easily combined with the physical forces which are produced by the various types of apparatus.

Very great strides have been made in the improvement of the method of applying gentle and continuous force by appliances fixed to the teeth, which exert their action by means of fine auxiliary springs. I think it right to say that we in this country have learnt a great deal from our colleagues in America, and would wish to pay tribute to them. There is no doubt that bone stimulation can be obtained by removable vulcanite plates with jack screws of a very fine thread. In the treatment of close-bite a plate is very useful. A block of vulcanite can be easily and accurately constructed whereby the mandible can be compelled to take up a more forward position, and a space be created between the posterior teeth. This is worn to allow the uppers to descend and the lowers to ascend from their sockets until occlusion is reached. If this over-eruption is accompanied by a growth of alveolar bone, then the cure of the close-bite will be of a permanent nature. If not, then a relapse to the original condition will occur. This growth takes a long time, and it is wise to recognise it fully. The effect of opening the bite, and especially of keeping the mandible forward, is similar to that obtained by an anæsthetist with an unconscious patient. There the obliteration of muscular tone allows the jaw to slip back, thus partially blocking the air way ; he therefore forcibly holds it forward. With the jaw in this position freer and fuller respiration is obtained, and a better oxygenisation of the blood results. This is reflected in a general improvement in the child's (general) health : often to a very noticeable degree.

I have found, both from private and hospital practice, that cases of this type—Class II—treated by the bite-plate above described, do not react to treatment satisfactorily at an early age, i.e. from eight to ten years. Better and quicker results can be obtained in cases at the age of twelve or even thirteen years. For some reason the first molars rise from their sockets more easily, and the second molars have no interruption to an eruption, which, if no treatment were carried out, would have stopped at a lower level. This fact, whatever be the exact explanation, was explained fully in a paper

read before the Society by Mr. Dolamore in 1925, entitled, " Inferior Retrusion." He distinguished between what he called physiological and pathological over-eruption of the teeth, and the idea is a very useful one. I think the Society owes him a debt of gratitude, for I have not heard the point emphasised before or since.

A further method of dealing with this lack or mis-direction of bone growth is simply to accept it, wholly or in part, and to reduce the number of teeth in such a way and at such a time that the teeth can come into (or be brought into) correct position, subsequent to the extraction. A point which I would emphasise here is that removal of the teeth may, and does, do a great deal toward the improvement of the case in a horizontal plane—antero-posteriorly. It can never do anything towards curing the critical, important, and very common feature : i.e. lack of growth in a vertical plane, close-bite. It is only with the greatest difficulty that anterior teeth can be retained in a more posterior position if the incisors are impinging close upon the cingulæ of the upper ones after the retainers are removed. Extraction of the teeth may be undertaken safely when vertical development is good, but if the bite is close there is, in my opinion, considerable danger of the mouth being disastrously mutilated. It is very important that the vertical abnormality should be cured, or at any rate under active treatment, before the teeth are removed.

It has been suggested that orthodontic treatment by extraction of teeth is what might be called " second best." Several speakers in discussion, and notably Mr. Pitts, have disputed this suggestion, and I would support these gentlemen. Reduction in the number of the teeth is essential and the very best treatment in suitable cases. At the same time, in listening to discussions, it seemed that extraction was thought to be an easy way of dealing with the situation. I am convinced that this is not so. To treat a case by extraction successfully, demands great care and experience, even if it be aided by subsequent or concomitant apparatus. There are many pitfalls to be avoided, and I have tried already to indicate one of them. It should be borne in mind that the arch of teeth must contract at the point of extraction : there is a falling backwards and inwards ; and this movement can, and does, take place into quite the later stages of orthodontic life, i.e. twenty to twenty-five. Moreover, removal of teeth does not always allow the remainder to be aligned or, more important, to keep correct alignment into adult life after retainers have been removed. A keen observation of adult cases, will I think supply evidence for this statement.

A further point to which I would draw attention for a few moments is the following : a case presents with good facial development, the chin is good, lips meet satisfactorily, no close-bite, but there is lack of growth in the premaxillary region. In order to reduce the prominence (which is not very marked) of the anterior teeth, it is decided to remove the two first premolars. The result is that the front teeth go back into good alignment, and the canines into a satisfactory position. After some years it may be seen, however, that the upper lip has fallen in and flattened. This allows the chin to appear to be unduly prominent, giving an impression almost

of a Class III deformity. Seen in profile, or even full-face, this result may be as displeasing as the original prominence of the front teeth. I brought forward a case of this type some few years ago. In this particular case stability has now been reached. Fortunately an even row of teeth is more highly prized than mere beauty of feature. The appearance of the case will remain as that of a strong silent he-woman, with a very prominent chin.

Mr. George Northcroft, in proposing a hearty vote of thanks to the President for his illuminating address, said he was sure all the members present had profited by it and were very grateful to the President for the care and trouble he had taken in elaborating the theme. He was sure also that the lack of discussion of the address was simply due to the fact that the members were somewhat shy of discussing the presidential pronouncement.

The resolution was carried with acclamation.

A PROPOSED FRAMEWORK FOR THE ARRANGEMENT OF A COLLECTION OF EXAMPLES OF ABNORMALITIES IN THE POSITIONS OF TEETH.*

By G. Northcroft, O.B.E., LL.D., L.D.S.

You will note that in the title of this Communication the word "proposed" is used, as it must be admitted with regret that this effort has not met with universal approval, and while it is hoped that the following demonstration will prove acceptable, any criticisms, however severe, will be welcomed in the hope that some such scheme may be heartily supported by all those who wish to promote the progress of our art and science, and to popularise the use of our museums, so full of priceless specimens.

Sim Wallace years ago remarked that of the making of classifications there is no end, and this Communication is an attempt to facilitate the arrangement of specimens connected with the study of orthodontics on a morphological basis, that can be adopted easily in all dental museums and that will ultimately aid the practitioner in diagnosis, and it is hoped will hasten the discovery of many ætiological factors at present unknown.

Simon has pointed out that the only sure foundation we have at present is such as proposed, classifications based on individual conceptions of ætiology or function being at present open to too much controversy.

The proposed arrangement then is merely a framework, the main headings making it possible to include all known anomalies, noting the association with these of certain general lesions, if such exist, without being too dogmatic about cause and effect. At the same time, such developmental faults as cleft palate and pathological conditions such as acromegaly have been deliberately excluded, and placed in other series in our ideal museum, because were this section of the museum accordingly enlarged for the reception of such specimens, it might give "Positional abnormalities of the teeth" an unbalanced prominence throughout the whole. As a starting point one can divide in one's mind all cases into two main groups as being (1) developmental in origin, many of which are looked upon as true "variations" and may be justly described as endogenous, and (2) those which have been induced by local conditions which are looked upon as "modifications" of the original plan, and can with equal justification be described as of exogenous origin. The above statements may at first sight seem

* *Transactions* of British Society for the Study of Orthodontics, February 4th, 1935.

to depart from the ideal of a purely morphological classification, but the divisions are so broad, and for the most part so well defined and simple, that for the sake of clarity and the ease of arrangement the possible error of seeming to stultify our ideal at the outset must be condoned.

By the kindness of Sir Frank Colyer and the Royal College of Surgeons, I am able to show specimens of all the different types of anomalies that have been collected, most of the actual models of which may be seen in the odontological section of the Royal College of Surgeons Museum. It should be explained that very often two or more abnormalities may occur in one specimen, in which case it is placed in the group where there are fewest specimens, or in the group of the malocclusion which seems to overshadow all the others, as for instance post-normal occlusion may be complicated by early loss of deciduous teeth—by general crowding—by spacing—by congenital absence of teeth, the incisors may be vertical, in proclination or retroclination—all these must be arranged under post-normal occlusion, but in separate groups. Again, all models and, where possible, skulls or portions of jaws, should be marked with the sex and age—this simple addition greatly enhances the use of the museum by research workers, and saves much time otherwise spent in looking up records in the catalogue; all the specimens in each compartment are then placed serially in age groups—this also brings out the age of incidence and duration of any anomaly. It should also be pointed out that no treated cases are placed in such a museum unless used to illustrate some point which has not been affected by the treatment.

An effort is made to correlate any specimens received with radiographic findings, profile and full-face photographs, and any medical history that may be available with the accompanying dates of—for the sake of example—the removal of tonsils and adenoids, serious illnesses, the exanthematous fevers, etc.

One of the drawbacks of a collection of skulls is that the sex, age and medical history are generally absent and can only be roughly guessed at.

Where possible the interest of a specimen may be increased by depositing models of parents and grandparents; all dental surgeons should try to train themselves to become "museum minded"—how often has one heard it remarked "what a pity we did not keep the early models of such and such a case."

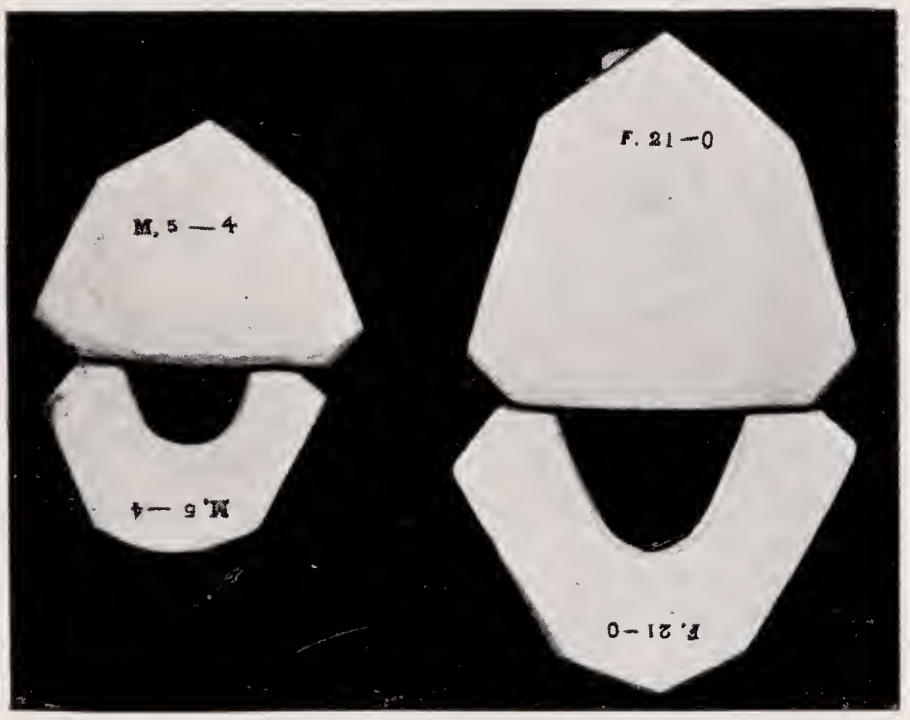
In an old museum the preparation of the specimens themselves is bound to differ with the fashion of the times, but uniformity in preparation adds greatly to the appearance of the cases as a whole. Looking back at the old volumes of our *Transactions*, great improvement will be observed in the presentation of cases illustrated by more carefully prepared specimens.

Some authorities prefer to rely entirely on the explanations in the catalogue of a museum, but surely even the most ardent research worker has not unlimited time at his disposal, and if museums are to be made popular and really useful, it must be, within the limits of clarity and good taste, a case of who runs may read, and a certain amount of information should be displayed within the cases.

In view of these preliminary notes it can be imagined what an amount of work has to be done before any individual specimen can be placed in its correct niche, and a catalogue number given to it, which catalogue never should be written according to the laws of the Medes and Persians, but altered as experience or a truer diagnosis denotes. It is advisable in numbering specimens to keep a decimal system, which enables extra models to be inserted quite simply without upsetting the numbers already recorded in the same group. The age and sex of the specimen are recorded as shown in Fig 1. An index is a prologue to the catalogue, but it has been cut up and placed at the beginning of each group. An index helps any research worker to turn quickly to the particular group of cases which he may wish to study. It is to be noted that there are twenty-six groups, so that each group starts with it own index number, followed by decimals, the number of which is only limited by the number of specimens.

Acknowledgment should be made to Dr. Evelyn Sprawson for some suggested and adopted emendations in the wording of some of the descriptive headings, and to all those of my many friends and confrères who have so kindly presented many valuable and interesting specimens.

A type specimen has been selected to illustrate each group and the accompanying catalogue description will be used for the purpose of explanation. It would become wearisome to multiply the illustrations, but it is hoped that enough examples will have been shown to give food for thought.



(Fig. 1.)

A Morphological Classification of the Variations and Modifications of the Positions of the Teeth in Man.

1. Positional Variations associated with Abnormal FRÆNA LABIORUM.

(Fig. 2.)

Female, aged 6.6. There is a wide space between the first maxillary deciduous incisors associated with well marked development of the frænum labii. The occlusion of the molars is normal.

2. Positional Variations associated with teeth ABNORMAL in form.

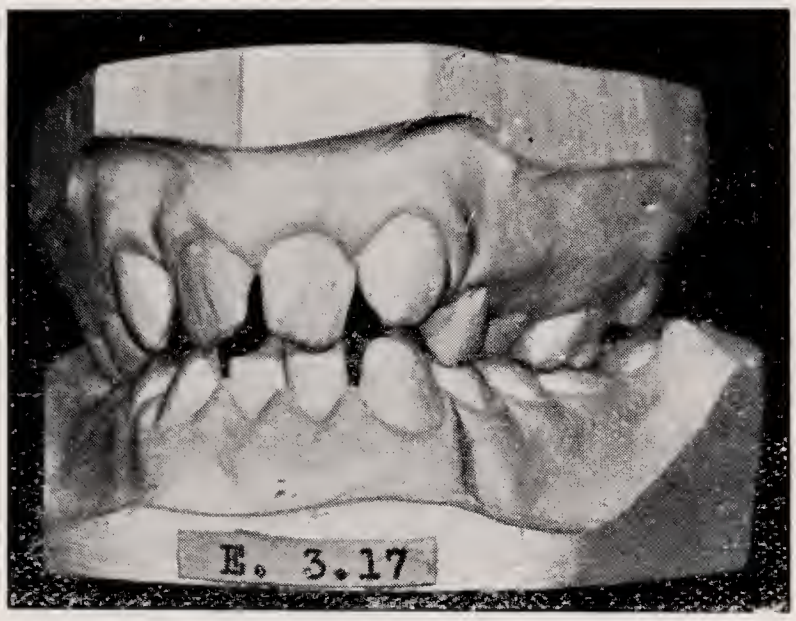
(Fig. 3.)

Female, aged 10.5. The first right mandibular incisor is larger than the first left incisor and shows an early stage of dichotomy; the radiograph shows only one pulp chamber; the deciduous mandibular canines have been lost and the right permanent canine is erupting external to the arch.

3. Positional Variations associated with ABSENCE of Teeth.

(Fig. 4.)

Male, aged 16.11. The second maxillary and mandibular incisors have never developed, as proved by radiographic evidence. There is left unilateral postnormal occlusion and the maxillary central incisors are rotated with their medial corners outwards.



4. Positional Variations associated with UNERUPTED Teeth

(Fig. 5.)

Female, Indian, aged 27. The mandibular left cheek teeth have not erupted; there is marked downward growth of the portion of the left maxilla carrying the premolars and molars. There is retroclination of the first maxillary incisors; the right premolars and molars are in occlusion.

5. Positional Variations associated with the presence of an EXCESSIVE NUMBER of Teeth.

(Fig. 6.)

Male, aged 14. There is an extra incisor in each premaxilla, the teeth being close to the median line; the first incisors are displaced away from the median line, and the second incisor is inside the arch.

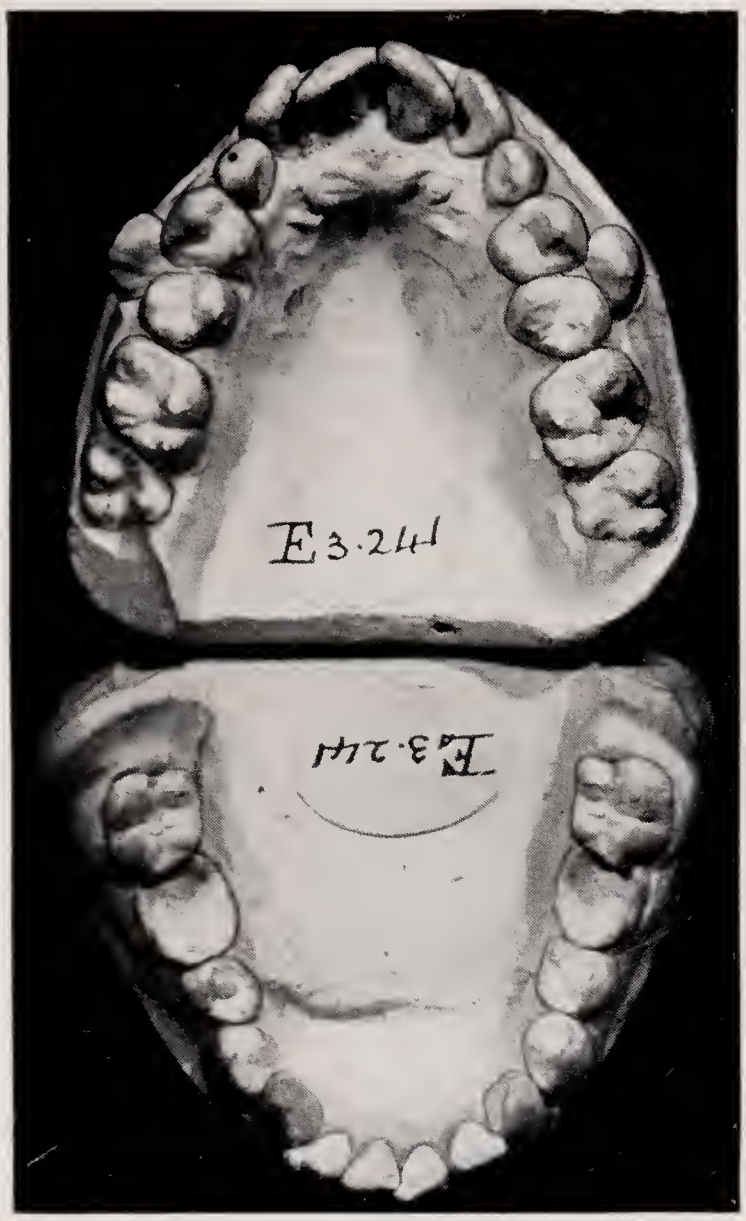
6. Positional Variations associated with AXIAL ROTATIONS of a Tooth or Teeth.

(Fig. 7.)

Male, aged 21.7. There is a cone-shaped supernumerary tooth on the internal aspect of the first incisors which does not interfere with the occlusion. The maxillary first premolars are rotated with the internal cusps pointing forwards. The external surface of the left first premolar is in contact with the anterior surface of the second premolar.

7. Positional Variations associated with the MISPLACEMENT of Teeth.

(FIG. 8.)



Unknown sex, aged 15. The maxillary canines have erupted external to and between the premolars; the deciduous canines are in position; the maxillary incisors are rotated.

8. Positional Variations accompanied by NORMAL ANTERO-POSTERIOR RELATIONSHIP of Arches associated with General Crowding.

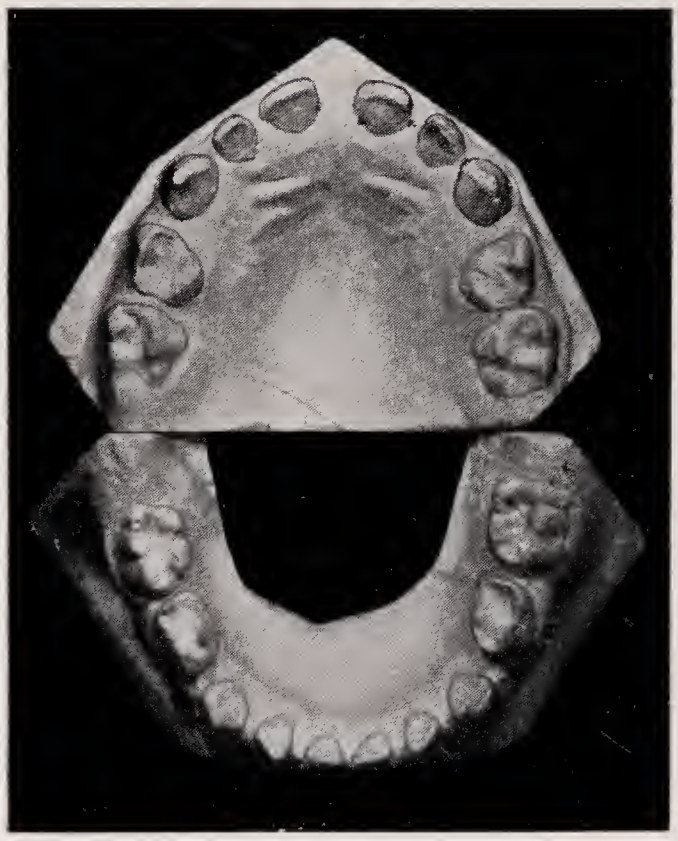
(FIG. 9.)

Female, aged 5.3. The maxillary incisors are separated and the first permanent maxillary molars are impacted, causing the absorption of the deciduous second molars, which were lost in consequence very early.

9. Positional Variations accompanied by NORMAL ANTERO-POSTERIOR RELATIONSHIP of Arches associated with General Spacing.

(FIG. 10.)

Female, aged 2.8. There is marked spacing between all the teeth, including the molars. The space between the maxillary first incisors is accentuated by the presence of an enlarged frænum, and it will be noted that the papilla palatina emerges between and in front of the first incisors. The right mandibular canine occludes externally, the second mandibular incisors are rotated with their mesial corners forward, which is a developmental position of these teeth. The mandible appears to be in a prenormal position for this age. There is evidence of arrested vertical growth in the incisor region, but no history to say if this was accompanied by any habit. It has been suggested that such a case should be called normal, but it is self-evident that it departs from the ideal in too many particulars.



10. Positional Variations accompanied by ABNORMAL VERTICAL RELATIONSHIP of the Arches associated with Open Bite.

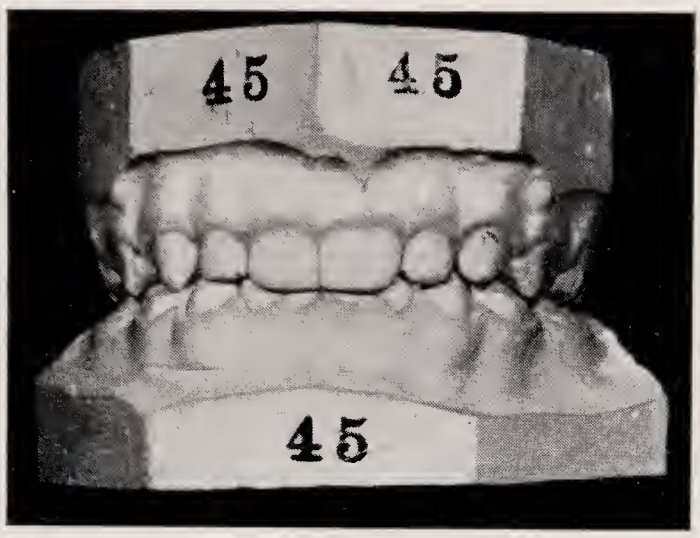
(FIG. 11.)

Unknown sex and age. The second right molars and the first molars and second premolars only are in occlusion. The maxillary incisors are rotated with their mesial corners outwards, the maxillary arch is narrow, and the left maxillary cheek-teeth bite internal to those of the mandible. Arrest of vertical development is obvious.

11. Positional Variations accompanied by ABNORMAL VERTICAL RELATIONSHIP of the Arches associated with Close Bite.

(Fig. 12.)

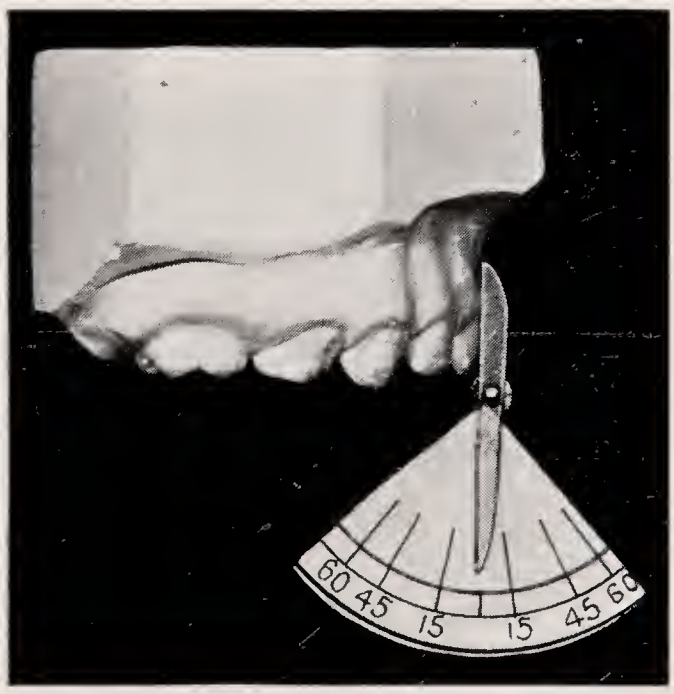
Male, aged 3.5. The maxillary arch is somewhat wide, the maxillary cheek teeth being a little external to the ideal. The first maxillary incisors almost completely cover the mandibular incisors, although these in their turn strike the cingula of the teeth above them. The mandibular incisors slope slightly backwards and a little internal to the ideal.



12. Positional Variations accompanied by POSTNORMAL RELATIONSHIP of the Mandible to the Maxilla in the Sagittal Plane associated with first Maxillary Incisors which are vertical to the Occlusal Plane.

(Fig. 13.)

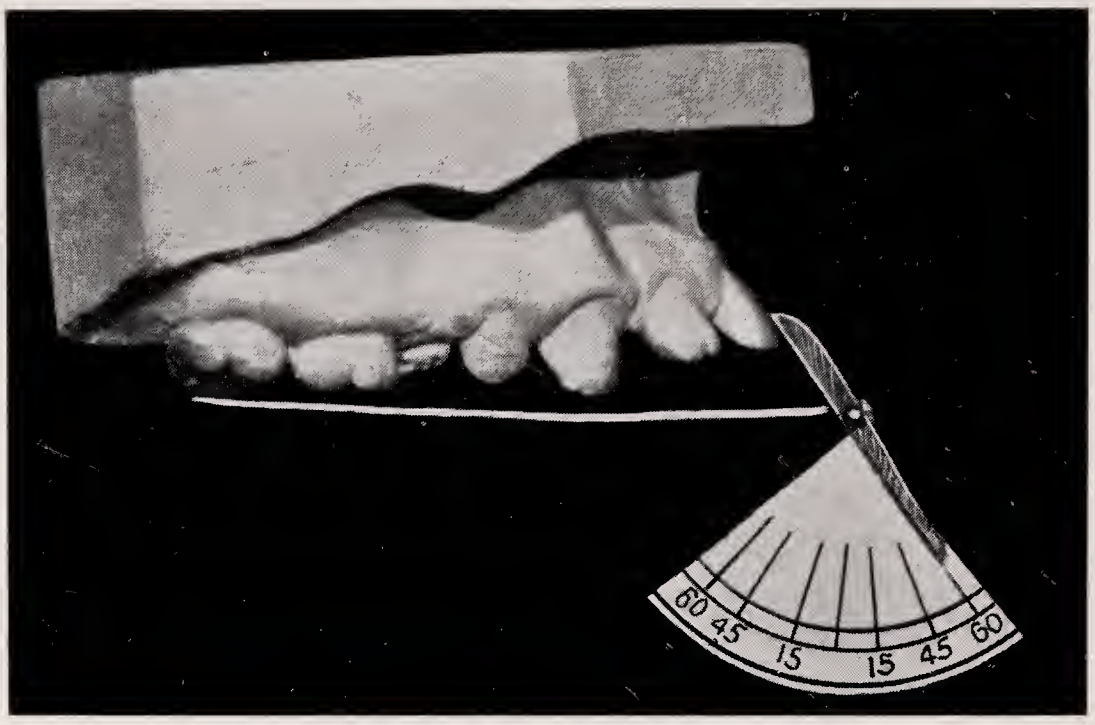
Male, aged 4. There is postnormal occlusion on the left and the incisor teeth are practically vertical. This is a refinement in the analysis of postnormal occlusion cases, first introduced to the notice of the profession by Miss K. C. Smyth.

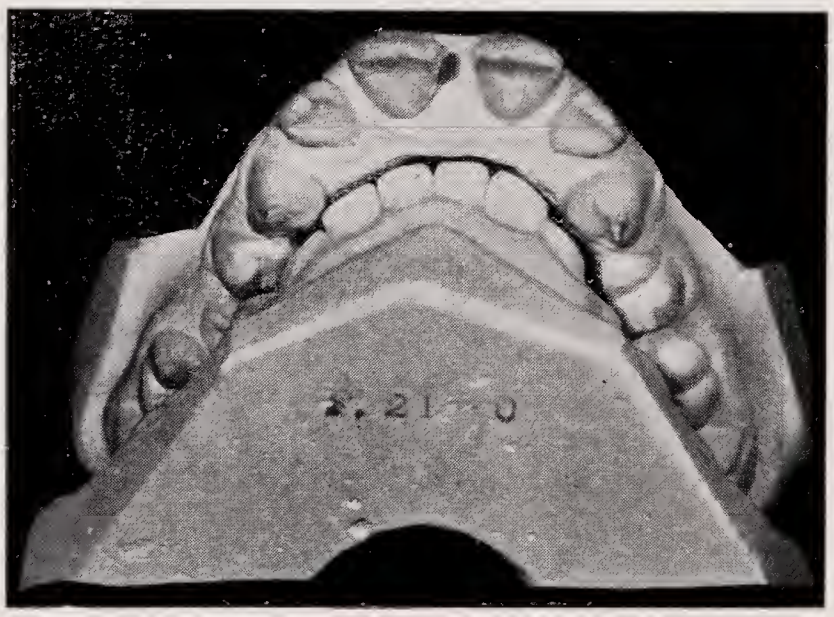


13. Positional Variations accompanied by POSTNORMAL RELATIONSHIP of the Mandible to Maxilla in Sagittal Plane associated with first Maxillary Incisors which are in proclination to the Occlusal Plane.

(Figs. 14 and 15.)

Female, aged 21. There is postnormal occlusion of the mandible. The angle of proclination of the first maxillary incisors to the occlusal plane is 60 degrees, accompanied by wide spacing. The mandibular incisors bite high up into the palate. The second maxillary premolars are diminutive and internal to the arch.

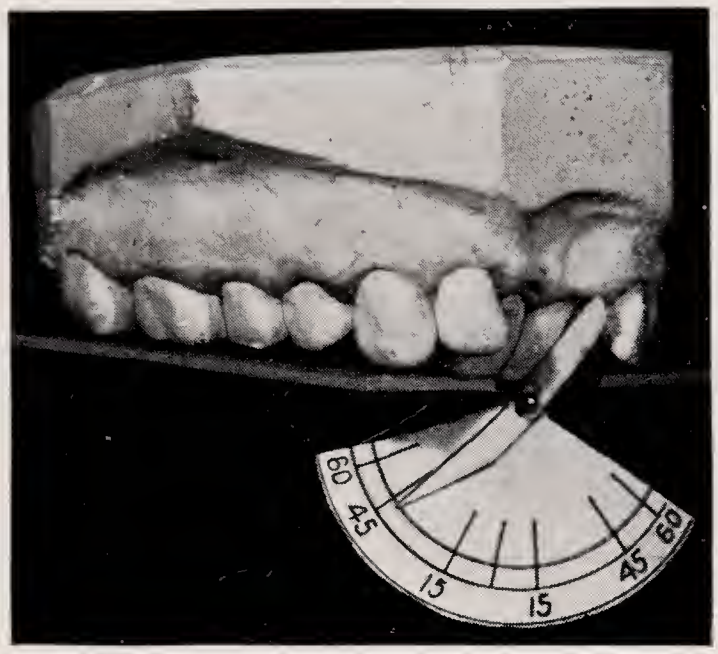




14. Positional Variations accompanied by POSTNORMAL RELATIONSHIP of the Mandible to Maxilla in Sagittal Plane associated with first Maxillary Incisors which are in retroclination to the Occlusal Plane.

(FIG. 16.)

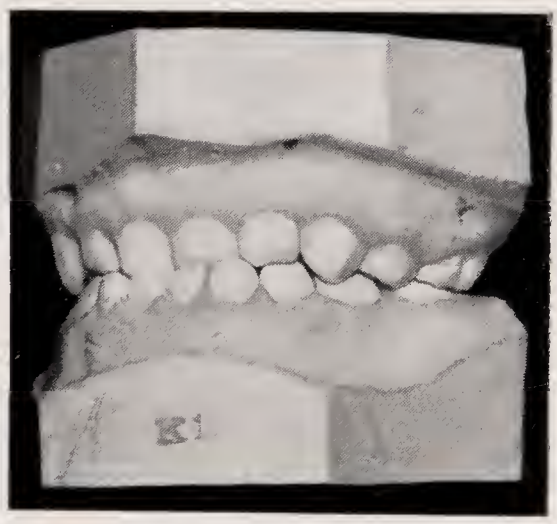
Female, aged 20. There is postnormal occlusion of the mandible, the angle of retroclination of the first maxillary incisors to the occlusal plane being nearly 60 degrees to the vertical, these teeth impinging on the gum at the necks of the mandibular incisors which in their turn touch the palate.



15. Positional Variations associated with PRENORMAL RELATIONSHIP of the Mandible to Maxilla in the Sagittal Plane.

(FIG. 17.)

Female, aged 2.10. There is prenormal occlusion of the mandible. The maxillary arch is flattened and the mandibular incisors are imbricated. This condition has been noted at a still earlier age.



16. Positional Variations associated with Abnormal EXTERNAL RELATIONSHIP of the Maxillary Arch or Teeth or INTERNAL RELATIONSHIP of the Mandibular Arch or Teeth in the Coronal Plane.

(FIG. 18.)

Female, aged 6. The left mandibular cheek teeth bite internally to those of the maxilla. There is postnormal occlusion of the mandible.

17. Positional Variations associated with Abnormal INTERNAL RELATIONSHIP of the Maxillary Arch or Teeth or EXTERNAL RELATIONSHIP of the Mandibular Arch or Teeth in the Coronal Plane.

(FIG. 19.)

Male, aged 40. The second right maxillary premolar, the first and second molars, are biting internally to the corresponding mandibular teeth.

18. Positional Variations associated with Abnormal COMPOSITE RELATIONSHIP of the Arches.

(Fig. 20.)

Female, aged 4.11. The maxillary arch is narrow and pointed, with lack of vertical development. The right cheek-teeth bite internally to the corresponding mandibular teeth. The mandibular incisors are imbricated. The left mandibular cheek-teeth bite externally to the corresponding maxillary teeth.

19. Positional Modifications associated with UNDULY RETAINED DECIDUOUS TEETH.

(Fig. 21.)

Female, aged 15. The deciduous canines and the second deciduous molars have been unduly retained. The left permanent canine is erupting internally to the arch and the second premolars are rotated and erupting internally to the arch.

20. Positional Modifications associated with PREMATURE LOSS of Deciduous or Permanent Teeth.

(FIG. 22.)

Male, aged 10.7. The maxillary and mandibular deciduous molars and the first left mandibular permanent incisor have been prematurely lost. The second right maxillary deciduous molar has been lost earlier than the one on the left side, and there is a greater forward drift of the right maxillary molar. Both the mandible and the maxillæ appear to be under-developed. There is postnormal occlusion associated with proclination of the maxillary incisors.

21. Positional Modifications of Teeth associated with HABITS.

(FIG. 23.)

Male, aged 4.4. There is postnormal occlusion and definite history of finger sucking since the age of 1. The left hand held palm forwards with middle three fingers in the palate. Breast-fed for three weeks only, then bottle. No serious illness. The maxillary arch is narrow and elongated, associated with spacing of the deciduous teeth. The mandible is very much flattened anteriorally and in postnormal occlusion. Nose breathing normal, size of tongue normal, condition of teeth good.

22. Positional Modifications of teeth associated with HABITS.

(Fig. 24.)

Unknown sex and age. There is a definite history of thumb-sucking associated with "open-bite."

23. Positional Modifications of teeth associated with HABITS.

(Fig. 25.)

Male, aged 5.4. There is a definite history of lip-sucking. The models have been oriented to the Frankfurt plane.

22. Positional Modifications of teeth associated with TRAUMATIC INJURY.

(Fig. 26.)

Unknown sex and age. The mandibular incisors are in proclination. It is recorded that there was much contraction of a cicatrix following on a burn.

23. Positional Modifications of teeth associated with SURGICAL TREATMENT.

(Fig. 27.)

Unknown sex and age. There is a cleft palate showing deformity of the arch following an operation.

24. Positional Modifications of teeth associated with TRAUMATIC INJURY at Birth.

(Fig. 28.)

Unknown sex, aged 6. There is postnormal occlusion. The child was breast-fed and had been entirely free from adenoids; there was no history of a "comforter" or thumb-sucking. There was a history of face presentation with considerable protraction of labour.

25. Positional Modifications associated with INFECTION OF TEETH.

(Fig. 29.)

Unknown sex and age. The septic deciduous teeth have been retained and the premolars are erupting externally to the arch. There is a retained left deciduous maxillary canine, a supernumerary tooth in the centre of the palate between the first maxillary incisors and the second right maxillary incisor is erupting internal to the arch.

26. Positional Modifications associated with DENTAL CARIES.

(Fig. 30.)

Male, aged 8.3. In the left maxilla there is a loss of 4.5 mm. through the forwaid drift of the first left permanent molar, which is biting internal to the arch.

Discussion.

Sir Norman Bennett, in opening the discussion, said he felt it was fortunate that Dr. Northcroft was a very old friend of his, because that enabled him to speak plainly and criticise the paper very freely, knowing that Dr. Northcroft would not mind it in the least. He entirely agreed with the general tenor of the scheme. He thought that teaching museums were badly needed ; books and illustrations in books were all very well, but it was a very great advantage if the student could have models to handle. That was, in fact, the next best thing to seeing the patient. He also agreed with Dr. Northcroft that accurate descriptions of the morphological facts as observed were the first thing to be put down underneath any specimen. It should not be necessary to refer to a catalogue for that description ; it should be under the specimen, so that anyone looking at it could see what the person who put it in the museum thought it showed, and could see whether he also thought it showed that. He would go a little further, however, and say that in addition there should be stated the reason, derived from the morphological facts, why the model was put into the particular category in which it was placed. With regard to the question of classification, Dr. Northcroft had quoted Dr. Sim Wallace as saying that of the making of classifications there was no end. Personally he thought that was a good thing, because it was only by trying to make classifications more or less on an ætiological basis that one got further forward, or rather further backward, in finding the cause of the conditions. If one was content with a classification merely on a morphological basis, one was merely observing facts and not taking a single step forward to try to ascertain what was really the matter. He therefore ventured to demur and to say that, because one's knowledge was incomplete, it was not wrong to attempt to make a classification upon an ætiological basis. Dr. Northcroft appeared to agree with that, because he gave his own case away by making a classification on the basis of what was exogenous or endogenous, in other words, on the basis of those abnormalities which were due to local causes or to developmental causes. In that he thought Dr. Northcroft was right, because knowledge in such matters had now reached the stage when it was possible in nearly every case to say whether the case was due to a local cause or to a developmental cause. To go a little further, in the case of each of the groups that were put down as due to local causes it was also known what the local cause was, as, for instance, thumb-sucking or retained deciduous teeth, and it was known what that local cause produced. In dealing with abnormalities of developmental origin, one was concerned almost entirely, he thought, with close and open bite, with errors of antero-posterior occlusion, post-normal mandible and so forth, and lateral malocclusion, i.e. malocclusion in three different planes. It was true that one did not know yet quite how far back to go in those cases. It was known that they were genetic but it was not possible at present to give the exact cause. He did not think, however, that that need prevent one from saying definitely that they were of developmental origin, and they might be classified accordingly. If he might indulge in some detailed criticism of the paper, he would like to know why the order was arranged in the way in which Dr. Northcroft had arranged it. No. 1 to No. 7 were exogenous or local, No. 8 to No. 17 were developmental, and No. 19 to No. 26 again were local. He did not know what to say about No. 18, because he did not know what it meant—"Positional variations associated with abnormal composite relationship of the arches." He thought it must be the kind of case that one got in consultation, when one did not know in the least what it was or how to treat it! He also had a bone to pick with Dr.

Northcroft with regard to the expression "general crowding." He did not like that expression. In another place and in a rather pedantic manner, he believed he had said that the term was of such vague significance as to merit disuse. On the present occasion he would say quite definitely that he thought it was a stupid term and meant nothing. The Oxford Dictionary defined a crowd as a throng or a dense multitude. That obviously did not apply to the mouth. The term "general crowding" called up in his mind six o'clock and a wet night and people trying to get on to a bus when it was full, and "general spacing" made him think of three o'clock on a fine afternoon when there were only a few people about—the idle rich who had come to London to spend their money in the afternoon, and, because English men and women when they were travelling alone always sat as far away from one another as possible, it made him think of the even spacing that was seen in the mouth. The conditions, however, were different. "General crowding" in a bus was due to too many people trying to get into the bus; it was not that the bus was too small; the Passenger Transport Board made them as large as possible. But in the case of the mouth the crowding was not due to an excessive number of teeth. In a small percentage of cases it might be due to there being large teeth in a small mouth; certainly teeth varied in size and sometimes one found abnormally large teeth. It was well known, however, that in 90 per cent. of the cases of so-called "general crowding," the cause was a reduction in the size of the jaws. Therefore he did not think it was right to use the term "general crowding," and he thought the same argument applied to "general spacing." He had some criticism to make with regard to Nos. 12, 13 and 14. He thought it was assumed in the description given of those cases that it was the mandible only that was at fault. If there was a postnormal mandible, relatively speaking there was a prenormal maxilla; in other words, one was describing the relative position of two arches. If one said which of the arches was incorrect, then one was making a diagnosis and not describing the abnormal relationship. If the lower molar was behind the upper molar, without diagnosing the case by other means one did not know which was at fault—whether the lower molar was too far back or the upper molar too far forward. It was very well known that in the great majority of the cases it was the lower molar which was too far back, but he submitted that in a classification, unless the two classes were going to be divided so that there were six instead of three, the wording must be altered to read somewhat as follows: "Abnormal antero-posterior relationship between the dental arches of the maxilla and the mandible." In Nos. 16 and 17, Dr. Northcroft had done what he suggested should be done in these cases, because Dr. Northcroft said that No. 17 was: "Positional variations associated with abnormal internal relationship of the maxillary arch or teeth or external relationship of the mandibular arch or teeth." There Dr. Northcroft did not commit himself; he said it might be the maxilla and it might be the mandible. The appearance was the same; the diagnosis was different. In conclusion, he wished to point out that criticism was easier than praise and, he was sure, much more satisfactory to the writer of the paper. He need only repeat that he was entirely in accord with Dr. Northcroft's object, and much more in accord with his methods than the criticism he had made would appear to indicate.

Mr. F. Bocquet Bull said he was sorry that Dr. Northcroft had omitted a class referring to cases of general disease. At the present time he had a patient of about twelve years of age who for four years had suffered from facial paralysis. The difference between the paralysed side and the normal side of the face was very marked indeed, and apart from the effect of the disease on the patient's face, a most marked effect was shown in the jaws and teeth. He presumed that under the classification given by Dr. Northcroft, such a case would have to be left out entirely. He liked the classification very much from a teaching point of view, and he thought that if it were put before a student in rather simpler language it would be a very good one for him to study in order to obtain an elementary knowledge of the subject. The language used by Dr. Northcroft in the classification was perhaps rather verbose, as most orthodontic language seemed to be.

Mr. Pitts said he had nothing but admiration for Dr. Northcroft's excellent classification, and he felt sure that a museum of orthodontic models classified in the way Dr. Northcroft had described would become at once the very best orthodontic museum in the world. He agreed that the classification of variations and modifications of position must be primarily morphological, because that system was relatively easy to follow. An accurate description of the different types of variations was the first essential. The ideal classification, of course, would be one of combined morphology and ætiology. It had always seemed to him, however, that the great difficulty in regard to that would be that it would become extremely complicated and would need a very large number of cross-references, because one might easily get certain types of variation with different forms of ætiology, and that would lead to some difficulty. The ideal might be to have two sections, one, the morphological classification and the other, the ætiological classification. On the other hand, it might be possible, by means of cross-references in the catalogue, to indicate the different sections of Dr. Northcroft's classification from the ætiological point of view. Dealing with the subject in more detail, he wondered whether logically there should not have been first of all some pre-eruptive abnormalities, which were of distinct importance. As variations of the teeth were in many cases obviously due to abnormalities in the jaws, he thought it would be logical to have a section devoted to models showing abnormal relationships before any teeth had erupted, as had been done by Miss Clinch and others. That would be highly important to the student, as indicating that many cases of abnormalities arose at or very shortly after birth, or possibly before birth. He thought that Dr. Northcroft's classification gave a certain fallacious simplicity to some of the sections which did not exist. For instance, there were many cases of antero-posterior relationship in which there were also combined a defect in the vertical plane and a defect in the coronal plane. He would like to know whether Dr. Northcroft had those in mind in the composite section, which Sir Norman Bennett said he could not understand. It was certainly true that there were cases which were primarily defective in the antero-posterior plane, but there might also be a close

bite in those cases and there might be a lingual occlusion of the upper molars as well. He thought that that particular variation might go into catalogue 12, say, and also be put in some other catalogue as well. In regard to No. 14, he agreed with Sir Norman Bennett that it did beg the question to some extent, because it rather assumed that the case was one of postnormal relationship to the mandible. That was presumably the familiar Class II, Division 2, case. Some years ago he had been asked to contribute a paper to a German journal, and in that paper he had the temerity to suggest some modification of Angle's classification. He ventured to put Angle's Class II, Division 2, cases into Division 1, which he extended to include not only cases of what was called superior protrusion but also cases of maxillary retrusion, with the mandible in the normal relationship, and cases of maxillary retrusion with the mandible in postnormal relationship. That was Class II, Division 2, and his argument was that all the evidence seemed to suggest that in Class II, Division 2, there was primarily a maxillary defect and that the postnormal relationship of the mandible was due to the maxillary retrusion, in contradistinction to Class II, Division 1, in which the protrusion of the upper teeth was dependent on the postnormal relationship of the mandible. He thought that Angle's classification gave a wrong emphasis to this particular type of malocclusion. He would like to have seen a section devoted to abnormalities due to the pressure of tumours, because those did give rise to very striking abnormalities. He could remember two being recorded before the Society. Mr. Warwick James showed a case of abnormality of the mandible due to sarcoma, and he himself showed an extreme degree of narrowing of the maxilla due to pressure of an angioma. If there was a section of variations due to general disease, such cases as those might be included and also cases of facial paralysis, to which Mr. Bocquet Bull had referred. He would like to offer his hearty congratulations to Dr. Northcroft. He appreciated the enormous amount of work that the classification must have entailed in the collection of models and the describing of them, and so forth. He was quite sure that when a museum came into being classified in the way Dr. Northcroft had described, it would be something of which every orthodontist in the world would be proud.

Mr. R. V. Bradlaw said Dr. Northcroft had pointed out that it was very desirable that radiographs of cases should be shown with the models, but personally he had found a great practical difficulty in that. The ideal way to show radiographs was, of course, in a frame with a light behind it, but that meant that a number of radiographs must be in a frame away from the models which they illustrated. The alternative to that was to print from the X-ray negatives and mount the print together with the models. The disadvantage of that method was that the print faded with time. Another print could be made, of course, but that presented a difficulty, because negatives got lost no matter how carefully they were stored, and it also involved remounting and a number of technical difficulties. He would like to know if Dr. Northcroft could suggest a way in which negatives could be set up close to the models with which they were associated.

Miss Smyth said she would like to add her tribute of thanks because the classification was very inspiring to anyone like herself who had any ambitions to make a museum of the kind in question.

Dr. Northcroft, in replying to the discussion, pointed out that a definite stand had to be made somewhere in designing a museum, and it seemed to him that it was better on the whole to collect specimens and describe them as one saw them. It seemed to him that a morphological classification did not raise so much controversy. He divided the endogenous cases of malocclusion, those due to developmental causes, into local and general, and that was why Nos. 1 to 7 were of local significance. For instance, if there was one tooth misplaced it was not a general developmental case but a local maldevelopment, and one inverted canine was what he considered to be a local endogenous condition. Similarly with an enlarged frænum : it was an open question whether the frænum caused spacing, but an enlarged frænum was a local developmental condition. The later numbers were the general endogenous causes. Practically all exogenous causes were local. With regard to the term "general crowding," having been given tentative charge of an established museum, he wished to upset as little phraseology as possible. So the term "general crowding" was retained.

Sir Norman Bennett : A very adequate explanation !

Dr. Northcroft said that he had applied the term "general spacing" to a new group of cases. He also agreed with Sir Norman's remarks as to postnormal occlusion. He had hesitated in deciding what to call postnormal occlusions, and he thought that he ought to treat them just as he had treated lateral malocclusions. One could not say definitely whether a case was postnormal or prenormal ; one could only describe it as either one or the other. That did not interfere with the placing of the cases in groups, it only involved naming the groups differently, and he thought that the naming of the group could be very well modified in that respect. With regard to Mr. Bocquet Bull's suggestion of a class of cases caused by general disease, most museums were limited in the matter of space, and he thought the classification he had given, though he did not consider it to be as complete as it might be, was as complete as the space would allow. The specimen to which Mr. Pitts referred was in the museum and was classified. It was catalogued there as a case of the pressure effects of tumours. He believed that if there was room, cases of cleft palate and modifications in the positions of the teeth, etc., associated with acromegaly might well be included. In answer to Mr. Bradlaw's question, he found it unsatisfactory to do anything but display positives by the side of the models. It would be quite possible, of course, to have an arrangement whereby anyone who wanted to see a negative could illuminate it by turning on a switch at the front of the case. That would be an ideal arrangement, but he did not think that many museum authorities would care to spend the money involved in such a scheme. With regard to No. E18, the composite case, it was postnormal one side and prenormal on the other ; there was lingual occlusion of the maxilla on one side and labial occlusion of the mandible on the other, and there was open bite. He would have put it either in the postnormal or the pre-

normal section, but there was nothing to indicate which condition started first or which was the main irregularity. He had not tried to make an orthodontic classification so much as to formulate some scheme of arranging models intelligently, so that both the orthodontist and the student could understand what they were looking at.

AN UNUSUAL CASE OF APPARENT PRENORMAL OCCLUSION.*

By Elsa M. Johnson, L.D.S.

The reason for calling this case one of apparent prenormal occlusion is because I think the profile and positions of the teeth give the appearance of being prenormal, but at the same time I am somewhat dubious of it being truly prenormal.

The patient is a boy, who was just eight years old when he first came for treatment.

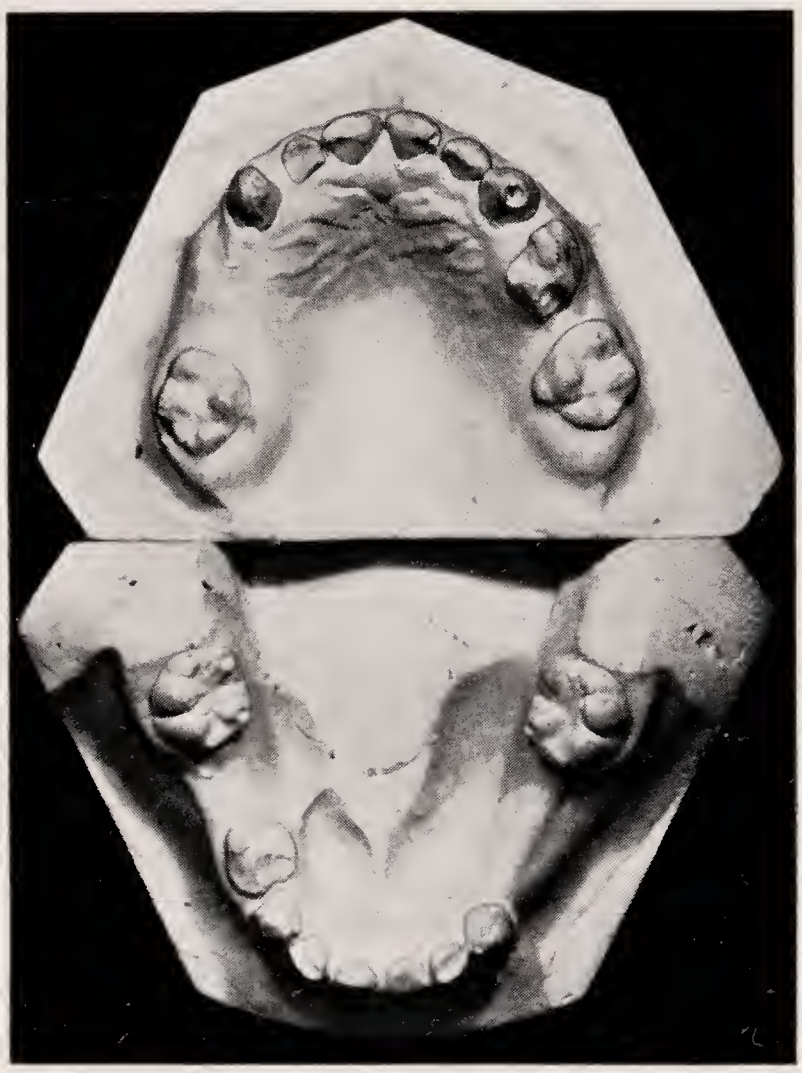


Fig. 1. (Occlusal views of upper and lower.) This slide shows the teeth present in his mouth. All the incisors are deciduous except the left lower central which is the permanent one just starting to erupt. I should like here to point out that the upper first permanent molars are rotated forward.

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FIG. 2. (Right and left sides in occlusion.) This slide shows the occlusion of the teeth. The upper incisors are behind the lower incisors. What is the molar relationship? Bearing in mind that the upper molars are rotated forward, is it not then prenormal?

The profile shows a certain prominence of the lower jaw and lip, and rather a flattened appearance of the premaxilla and upper lip. X-ray photographs were taken to ascertain the presence of the permanent incisors. They showed that there were none missing. The first stage of the treatment was the extraction of the lower deciduous central and lateral incisors, followed shortly afterwards by the extraction of the corresponding upper teeth. I am now in doubt of the wisdom of these extractions as I believe the subsequent treatment of moving the permanent upper incisors over the bite was rendered more difficult.

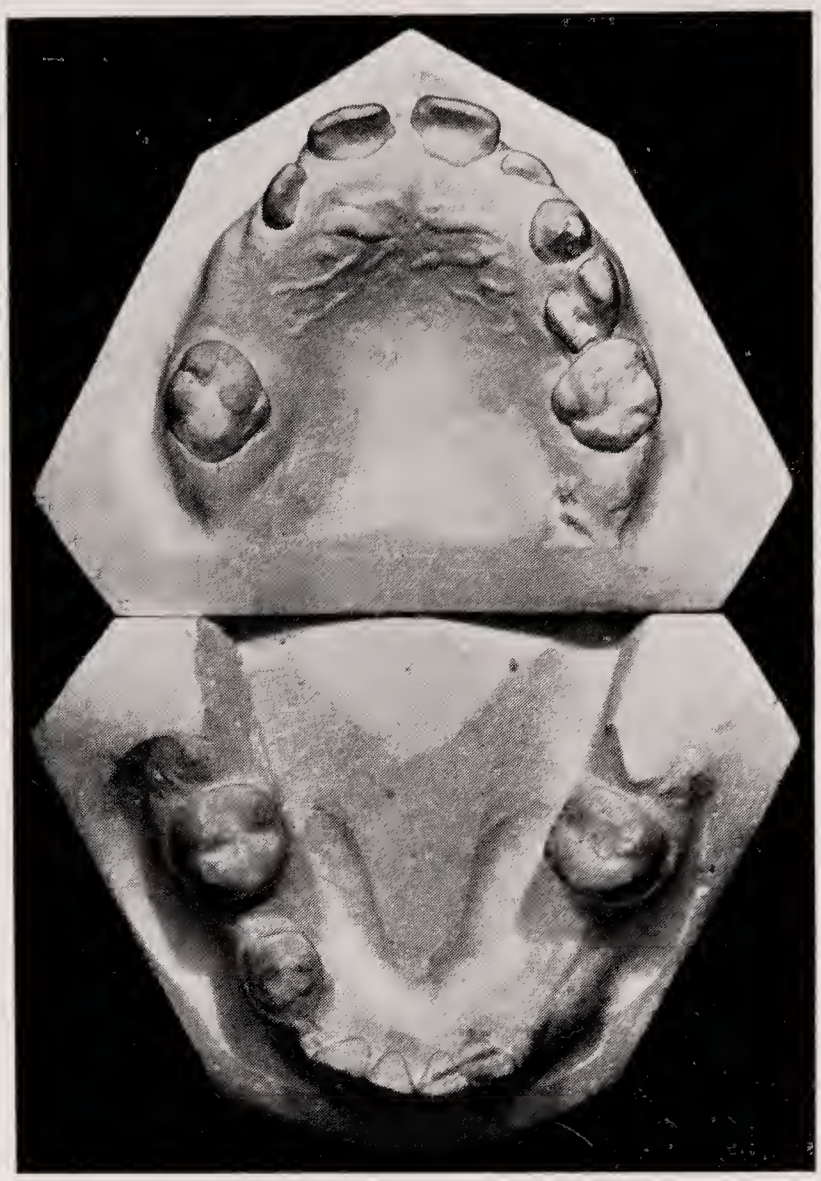
The first permanent upper incisor to appear was the left central; it was well behind the lower incisors, of which the centrals were fully erupted, and the laterals half erupted. There was an overlap of the lower centrals above the upper gingival margin of three or four millimetres. After various attempts to reduce this overlap I made an appliance of gold crown forms fitted to the lower first permanent molars with a lingual arch. These crown forms raised the bite the required amount. At the same time I inserted a lingual appliance in the upper jaw, with a spring to push forward the left central incisor.

I noticed at this time that the boy had a large range of antero-posterior movement in his lower jaw. Three weeks later the left upper central was nearly over the bite. I noticed, however, that the left lower deciduous canine was locking with the left upper deciduous canine, thereby keeping the lower jaw in a forward position. This lower tooth was extracted. Immediately the left upper central incisor appeared further over the bite, thus showing that the lower jaw had been allowed to drop back as a result of this extraction. A week after this the left upper central was completely over the bite, and the boy assured me that the new position was more comfortable than the old.

The right upper central incisor was now appearing, so I added a spring to the appliance, and after a fortnight this tooth was over the bite. The boy's appearance was now greatly improved.

(FIG. 2.)

(FIG. 2.)



(Fig. 3)

Fig. 3. (New occlusal views.)

Fig. 4. (New models in occlusion.)

I have outlined briefly to you the treatment undertaken in this case, and I must admit that I am still doubtful whether this is a true prenormal bite or an acquired one which responded to treatment.

I should like to thank Mr. Endicott for the kind help that he has given to me, and for his permission to allow me to present this case, which I treated under his supervision at the Eastman Dental Clinic.

Discussion.

The President said Mrs. Johnson had emphasised the importance of orthodontists making a correct diagnosis of any case that they were called upon to treat. He was sure everyone present would wish to congratulate her upon the very clear way in which she had presented the case.

Sir Norman Bennett said he had had an opportunity of seeing beforehand the models which Mrs. Johnson had shown on the screen and he had brought with him two slides of a case which he thought bore somewhat upon the problem with which Mrs. Johnson had had to deal. The first models were taken on the third birthday of the patient, who was a boy. They showed slightly prenormal occlusion of the mandible in the molar region. They also showed that the upper central incisors were inclined lingually and that the lower incisors also to some extent were inclined lingually to correspond. The lower incisors were, of course, in prenormal occlusion. Following the advice given by Dr. Northcroft and Mr. Chapman from time to time, he did not treat the case in any way as the child was only three years old. About three years elapsed before he saw the child again, and he then found that the condition had cured itself. It was obviously a case of habit.

(Fig. 4.)

(Fig. 4.)

He thought the habit the child had of biting the lower incisors in front of the upper ones had pushed the upper ones back. Therefore the molar occlusion was only very slightly abnormal. The next models showed the patient at the age of about seven years. There was rather a deep over-bite, but otherwise there was nothing at all abnormal. With regard to the case described by Mrs. Johnson, he would not like to say whether it was a case of habit or a genuine case of prenormal occlusion, but what Mrs. Johnson had said about the readiness with which the jaw went back, showing that the condyles were slightly in front of their proper position, made him inclined to think that it was a case of habit, similar to the one he had just shown. So far Mrs. Johnson had been successful in her treatment of the case, but he would like to know what she was going to do next, because she could not leave the artificial crowns on for ever and if she took them off there would then be a deep over-bite. He suggested that the case had now arrived at the stage when the crowns should be taken off, and the over-bite corrected by means of a bite-plate articulating with the lower incisor teeth.

Miss K. C. Smyth said she had two slides which she would like to show in connection with Mrs. Johnson's communication. The case was entirely untreated. The child came to her a few weeks ago, and, at the first glance, the mouth revealed a similar condition to that obtaining in the cases described by Mrs. Johnson and Sir Norman Bennett. She had been about to launch into an explanation to the child's parent of the probable necessity for treatment and of the kind of abnormality that was present, but she had fortunately refrained from doing so until she had looked at the occlusion of the case. She would now like to know whether it could be called a prenormal case or a postnormal case, or whether it was an apparent prenormal case or an apparent postnormal case. It was the first case she had ever seen in which the lower incisors bit outside the upper incisors and yet there was a marked degree of post-normal occlusion in the molar region, without any teeth having been lost. The upper deciduous incisors were worn down tremendously, and that was the feature of the case which particularly worried the mother. The appearance of the boy was not very far from the normal but in the front view particularly a flattening under the nose would be noticed. It was more noticeable in the front view than in the profile view, but perhaps the apparent normality of the profile view might be due to the fact that there was undoubted flattening under the nose and a slight postnormality, so that there was flatness in both the upper and the lower jaws in the front of the mouth. She showed the radiographs because she thought it could just be seen that the upper permanent incisors were definitely very crowded. This indicated a definite lack of bone growth in that region, whereas it would be seen that there was not so much deficiency in lateral growth, because the radiograph on the right showed a certain amount of spacing of the crowns of the incisors and even more spacing of the roots. The intercanine breadth was not really very narrow, yet the whole arch seemed to be squashed in front and this gave rise to the flattening under the nose. The case seemed to be similar in some respects to the one Mrs. Johnson had described, and dissimilar in other respects.

Dr. George Northcroft said that Sir Norman Bennett had very clearly pointed out that there might be all sorts of permutations and combinations of the conditions that obtained in the mouth, and he thought that fact should never be overlooked. It was evident that the case shown by Mrs. Johnson was one of maxillary postnormality and

not prenormality of the mandible. The condition was rare and as a general rule one found a prenormal position of the mandible and the maxillary teeth in their normal position.

Mrs. M. P. Michaelis asked if any attempt had been made to treat the case described by Mrs. Johnson without raising the bite. Some time ago she had read a communication to the Society in which she had endeavoured to show that such cases could be treated without raising the bite. Some of the cases were quite as bad as Mrs. Johnson's. It seemed to her that the covering of the crowns of the teeth must make the bite closer, since it could only depress the teeth which were so covered and could not in any way open the bite. She thought that if the bite were to be opened now it would have to be opened from behind the incisors, and not with a wedge on the back teeth, which would push those teeth further down into their sockets.

Mr. A. T. Pitts said he was inclined to think that both the cases that had been shown were really cases of maxillary retrusion. He did not think that that was a very uncommon condition, because it seemed to him that quite a number of the cases in which the lower incisors were found to be in advance of the upper incisors were cases of maxillary retrusion and not mandibular protrusion. It was quite common to see cases in which the lower incisors were in advance and the molar occlusion was certainly not prenormal. Even in the true prenormal cases, however, there was always an associated maxillary retrusion, which was often just as much an æsthetic blemish as the actual prenormality in the lower jaw and equally needed correction. He suggested that that was what had happened in the case shown by Sir Norman and he thought it was quite likely that it had also happened in the case shown by Miss Smyth. Miss Smyth's case was really an extreme one of Angle's Class II, Division 2. He had never actually seen a case of Angle's Class II, Division 2, in which the upper incisors were inside the lower, but there was no reason why it should not occur. He would not be at all surprised to find that, if Miss Smyth's case was seen a few years hence, it would be a much more typical example of Class II, Division 2. It was of interest to him because in his presidential address some years ago he had tried to point out the affinities between malocclusion in the deciduous dentition and malocclusion in the permanent dentition and the quantitative and qualitative changes in types of malocclusion in the two dentitions. He would therefore be most interested to see what would be the change in the dentition in the case shown by Miss Smyth, without any treatment, a few years hence. Perhaps Miss Smyth would refrain, in the interests of orthodontic science, from treating the case ?

Mr. C. L. Endicott said the question as to whether the crowns should be left on in the case described by Mrs. Johnson was a debatable point. If they were removed at the present time the bite would come on two lower incisors or possibly on four, and the idea in leaving the crowns on was to endeavour to distribute the bite over as many teeth as possible for the time being. With regard to Mrs. Michaelis's question about the necessity of using crowns, he very seldom advocated the use of any type of appliance to help the bite in such cases, because it was generally a very simple matter to correct the case without doing so. The models put on the screen, however, showed the real depth of the overbite in the particular case in question, and it was very difficult to do anything without using something of the nature of the appliance that had been used. In his experience, it was generally possible in such cases, before starting treatment, to move the lower jaw back so that

the incisor teeth came end to end. Some time ago Mrs. Lindsay had spoken to him about an article she had read in a Continental journal on true and apparent Class III cases, and he wondered if she had done any work on the subject.

Mr. Pitts asked Mrs. Michaelis if there was the slightest vestige of evidence to suggest that molar teeth were depressed when crowns were put upon them.

Mrs. Michaelis said that members of the Society for whom she had very great respect had stated quite frequently that a depression was caused in the molar region, and she herself had noticed that a bite had become closer after crowns had been worn. About nine years ago she had treated a case in such a way, capping the teeth, and at the end of six months the bite was definitely closer, sufficiently so for her to have been a little ashamed of herself for treating the case in that way.

Mr. Pitts thanked Mrs. Michaelis for her explanation and regretted that it had failed to convince him.

Mrs. Johnson, in replying to the discussion, said Mr. Endicott had answered Sir Norman Bennett's question as to the future treatment of the case. The crowns had been kept on in the hope that some premolars would erupt so that the patient could bite on those. She believed that two of them were now showing signs of erupting, and as soon as they came into occlusion the crowns would probably be removed. Some X-rays had been taken quite recently, and no damage seemed to have been done to the lower molars so far. Miss Smyth had said that in the case she showed the deciduous incisors were very much worn down. That was so also in the case she had described in her communication. Another point of similarity between the two cases was that the upper incisors in both were rather crowded. Mr. Endicott had replied to Mrs. Michaelis, but she would like to point out that, when the upper incisors first showed signs of erupting, the lower incisors were overlapping the gingival margin about 3mm. to 4mm., so that the upper incisors could never have been got over the bite without help. With regard to the strain on the lower molars, she had pointed out that a lingual arch had been made which it was hoped would spread the strain round the mouth.

SOME EVIDENCE CONCERNING THE NATURE OF BIMAXILLARY CROWDING.*

By Axel F. Lundström, Stockholm, Sweden.

For several years past there has been a decided tendency among dental scientists to regard the diseases of the teeth as local symptoms of some general disturbance. For example, dental caries has by quite a number of authors been considered as a result of faulty diet. Several investigators who have had their interest focussed on the irregularities of the teeth, have followed similar lines of thought, and have tried to explain these abnormalities as local manifestations of general disorders. The latter have sometimes been supposed to be of endogenous nature or results of faulty diet. Other authors have stated that they are results of local factors, as insufficient use of the teeth.[1]

The general appearance of patients with malocclusions and the common occurrence of these anomalies among otherwise—to all appearance—perfectly healthy and normal individuals, has for many decades in all probability made the impression on operators that a considerable proportion of the cases of malocclusion cannot very well be ascribed to these causes alone. Some other hitherto unknown factor must also be active if malocclusions of certain types appear. At present it seems probable that certain malocclusions ought to be regarded as idio- and mixo-variations, that is to say, they are hereditary phenomena.[2] In that case it would seem a rather hopeless task to ponder over their causes or try to prevent their appearance, as they must be unavoidable for the individuals in question.

If we now find that malocclusions occur in cases where no disturbance of a general character can be discovered, we must admit an increased validity in those arguments which have been advanced as reasons for the assumption that certain malocclusions have not necessarily been preceded by any dietetic or endocrine disturbance. In some of my previous articles I have tried to present some facts which I believe cannot be made to agree with the theory of the connection between subnormal masticatory function and certain types of malocclusion. In this paper I will show some cases which appear to me to indicate that bimaxillary crowding is by no means necessarily connected with a general disturbance of growth, in so far as a disturbance of that nature can be diagnosed from X-rays of the wrist. With normal occlusion or, as Simon[3] more logically calls it, anatomically perfect occlusion, in man, the teeth are in approximal contact. As the line connecting the two approximal surfaces or "contact points" is in a number of teeth the longest diagonal of the tooth in the horizontal plane,

* *Transactions* of British Society for the Study of Orthodontics, March, 1935.

one or more of these teeth will be forced into an abnormal position in cases with insufficient space.*

This lack of harmony between the sum total of the mesio-distal diameters and the apical base may be the result of various conditions. We may imagine that it is a result of normal width of the teeth and a too small base, an abnormally large width of the teeth and a normal base, and also abnormally large teeth and a small base, etc.

Regarding the bimaxillary crowding, we might accordingly offer for consideration whether it may be simply the result of abnormally broad teeth. In that case the maxillary and mandibular bases and, in fact, all the other regions of the face, would be "normal," or, in the terminology of Simon, anatomically perfect. The only disturbing factor would in this case be the size of the teeth. I am not aware of this hypothesis having been advanced before, but it seems evident that it would be worth while investigating. However this may be, it is certain that we more often find writers on orthodontic subjects assume that the size of the teeth is correct, the jaws or at least the apical base being too small.

If the jaws are too small, this conclusion may appear obvious, that they are underdeveloped. The causes of a subdevelopment will naturally be sought for among factors which from more or less well-founded reasons have been looked upon as causing growth deficiency.

The most important causes of growth deficiency, and which consequently also would be considered as giving rise to a crowding of the denture, are the following :—

1. Insufficient function.
2. Faulty or insufficient diet.
3. Disturbance of the endocrine balance.
4. Other pathological conditions.

It is the third group we will discuss in this paper.

For many years now crowded dentures have been observed in individuals with disorders of growth. Kingsley[4] examined the dentures of dwarfs and found cases of considerable crowding. Since then we have had many records of the coincidence of malocclusion and endocrine disturbance. Figs. 1, 2, 3 are examples of malocclusions in individuals with a general growth deficiency. As a general rule a deficiency in growth and development was observed to occur in connection with endocrine disturbances. In the cases in question the crowding of the teeth seemed to be in some way associated with the endocrine system, and moreover, crowded dentures appeared to be related to an insufficient amount of bone in the region beyond the apices of the teeth, so that it is easy to understand that the crowding of the teeth came to be looked upon as a symptom of a similar disorder.

This line of reasoning can hardly fail to give rise to the opinion that, in the treatment of certain malocclusions, the general growth and endocrine condition ought to be objects of the orthodontist's attention. The growing tendency to range dentistry among the

* "Insufficient space" may also occur in cases where the apical base is fully developed, when lip pressure or something similar displaces the teeth. The more common cause of insufficient space appears to be a sub-development of the maxillary or mandibular bases. Only the latter form of crowding is discussed in this paper.

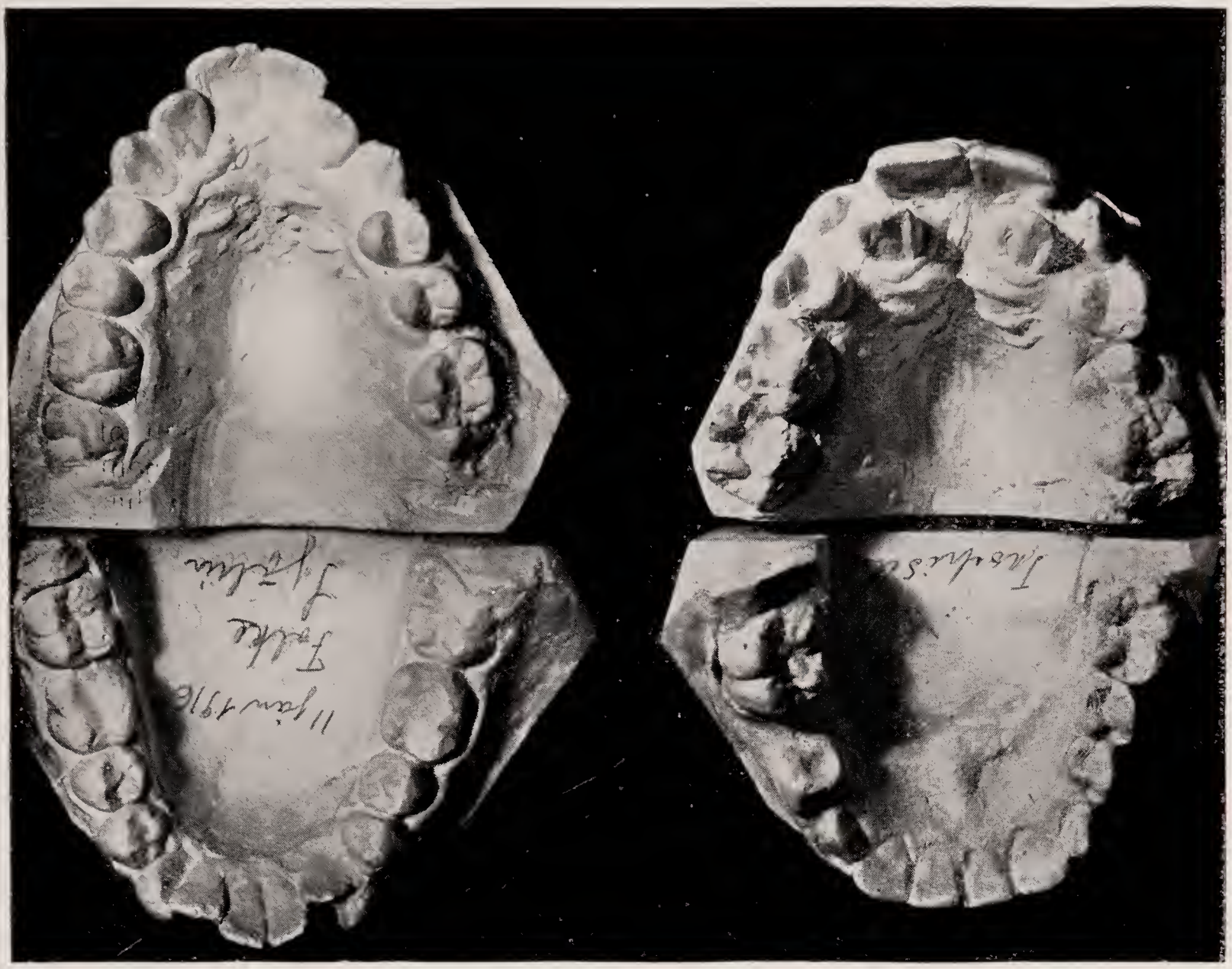


Fig. 1. Malocclusion in a case of endocrine deficiency.

Fig. 2. Malocclusion in a case of endocrine deficiency.

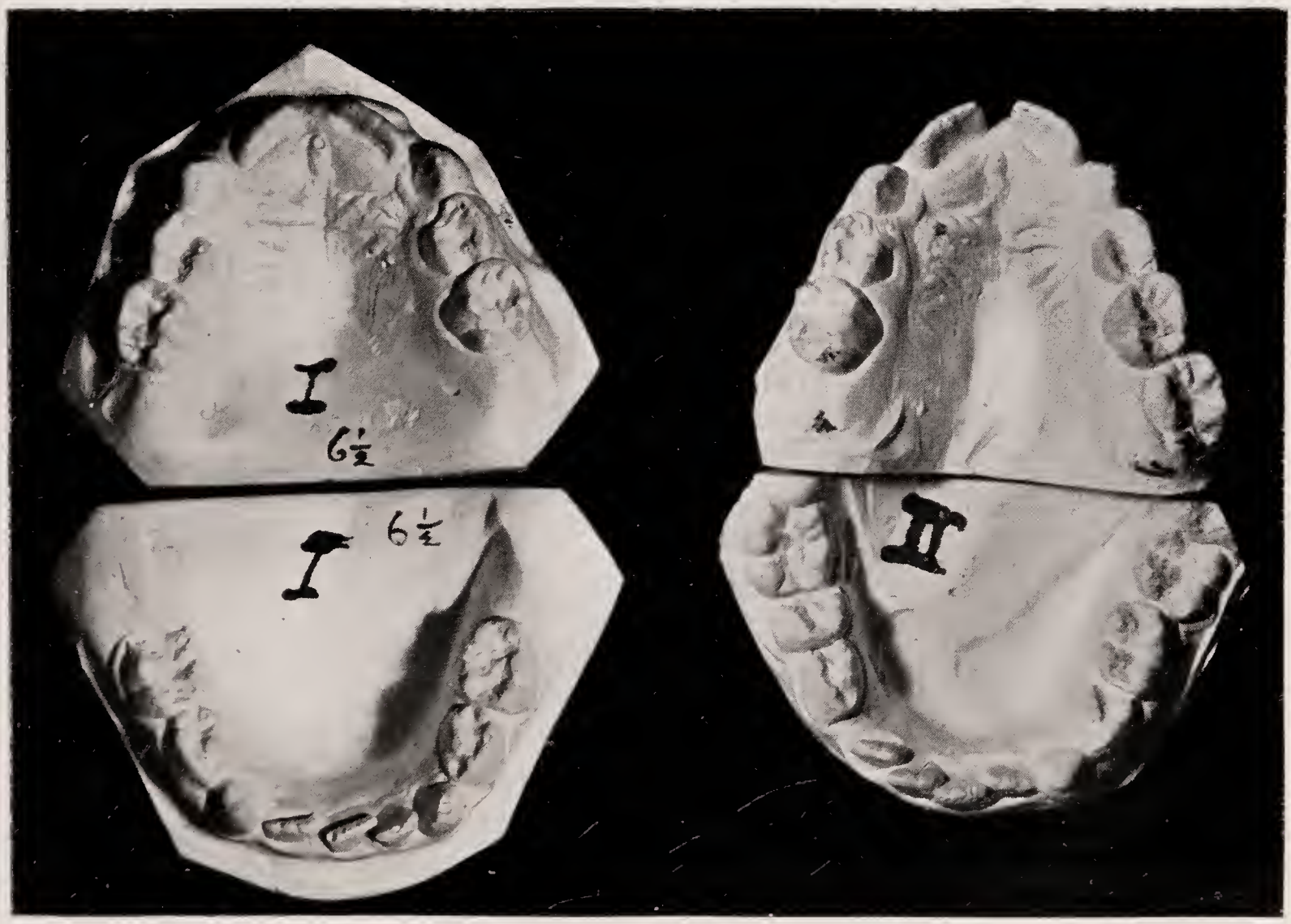


Fig. 3. Case No. 40. Age 6½ years, 2½ to 3½ years late skeletal development. Dentition 1½ years late.

Fig. 4. Case No. 40. Age 7 years, 10 months. Skeletal development, 1 year 10 months to 2 years 10 months late. First permanent molars not in occlusion.

other branches of medicine will also contribute to make this doctrine popular.

Josefson[5] seems to have been the first to have made the suggestion that before starting an orthodontic treatment the patient ought to be examined as to his endocrine condition. He described a case which he considers ought to serve as a prototype regarding how these cases ought to be handled, and he states that it is his conviction that if the dentist " to whose notice similar cases first come, would consider the retarded eruption of the teeth from the standpoint of endocrinology, many children would be spared the ordeal of wearing special apparatus in the mouth during a long period." Josefson is of course quite right from his own point of view, viz. that it is wrong to start an orthodontic treatment without taking into consideration the ætiology. But he has evidently mistaken the objective of orthodontic treatment. He has heard that it is a common practice to move a buried tooth into position by means of appliances, and has consequently imagined that similar methods are used to accelerate the eruption of the permanent teeth when all were retarded, that is in cases of general arrest of growth.

Now it is true that something similar has occurred, as several orthodontic writers (for example Bogue and Barnes) have recommended a very early expansion, even before any permanent tooth had erupted, in cases where a lack of spacing in the temporary denture seemed to prognosticate crowding of the permanent teeth. But it must have been merely accidental that hypothyroid and other similar individuals have been subjected to orthodontic treatment to accelerate the eruption of the teeth.

Josefson has made the statement that he has occasionally met cases with endocrine disturbances, in which at the first inspection, that is before the X-ray examination, nothing more than the development of the denture indicated any disturbance of this kind. However, his descriptions of his cases show that other clinical symptoms were frequently obvious. On the other hand, the majority of patients applying for orthodontic treatment do not as a rule vary from other children in any general respect. And as will be shown later, my own cases do not exhibit any universal retardation regarding the eruption of the teeth.

It seems to me that in planning the treatment of malocclusion orthodontists as a rule assume that no general arrest of growth need be taken into consideration. The time for the mechanical interference is chosen with regard to dental or other local conditions. Consequently we find reports of treatments of cases of practically all ages from three or four years up. Against this disregard of the general developmental conditions, a stand was taken by Howard.[6] In a series of papers this author drew the attention of the profession to this question, and laid down as a rule that it is not good practice to expand a crowded denture without having previously, by means of X-ray examinations of the wrist, ascertained that the skeleton is in a state of normally active growth.

The fulfilment of this demand requires a considerable change in the routine of the preliminary examinations we have been used to undertake before starting an orthodontic treatment. It seems

probable that the reading of Howard's papers gave many operators a shock. At least that was the effect on myself, so I decided to undertake control investigations at the Department of Orthodontics of the State Dental College of Stockholm, and thanks to the kind and valuable help of the chief of the X-ray department of the same college, Dr. Gustaf Herulf, I succeeded in collecting some material for the study of the problem.

The object of this investigation is to find out :—

1. Any relation between different varieties of apical base subdevelopment and the degree of development of the skeleton of the wrist.
2. Any relation between the lateral growth of the arch and the growth of the bones of the hand.

The material was collected from fifty-four patients who applied for advice or treatment at the orthodontic department. In a number of cases it was necessary to take the impressions in a plastic material on account of the students' lack of method. X-rays of the wrists were taken at the same time. New impressions and X-rays have been taken after periods of $\frac{1}{2}$ to 1 year. In several cases measurements and notes have been used as a substitute for impressions. The determination of the degree of the development of the wrists has been made by Dr. Erik Lysholm of Serafimerlasarettet, for which kind assistance I now take occasion to present my best thanks.

The eruption of the permanent teeth has been timed according to the standard for Swedish children, which was arranged by Rôse.[7]

As I have just mentioned, the determination of the wrist development was checked by Dr. Lysholm. In Josefson's book this latter author expresses the degree of the disorder by comparing the X-ray of the patient with an X-ray of a normal individual of the same age. An ocular inspection gives a general view of the condition. If we compare X-rays of the same individual at intervals, the advance is obvious (Figs. 9-13). The growth may to a limited extent also be expressed in figures. This was done by Cohn,[10] who gives the proportion between the diaphysis and the epiphysis of the ulna as an expression of the degree of development in children. I have tried to use three different indices :—

$$1,\ \frac{\text{diameter of the epiphysis ulnæ} \times 100}{\text{diameter of the diaphysis ulnæ.}};$$

$$2,\ \frac{\text{diameter of multangulum majus} \times 100}{\text{the largest diameter of capitatum.}};$$

$$3,\ \frac{\text{diameter of naviculare} = 100}{\text{the largest diameter of hamatum.}};$$

In the case shown in Figs. 9-13, these indices were :—

	8 years	$8\frac{1}{2}$ years	9 years	$9\frac{1}{2}$ years	10 years
Index 1 ...	34	—	67	—	71
,, 2 ...	40	40	45	47	50
,, 3 ...	47	50	59	65	68

As might be expected, the different numbers show a progression when they are taken from the same individual. In different individuals the numbers show considerable variations in the same

index and age. In seven 8-year-old girls with a normal development for that age they varied as follows :—

	A	B	C	D	E	F	G
Index 1	94	86	62	81	86	67	100
,, 2	57	61	50	53	50	53	65
,, 3	80	67	85	73	80	71	76
Index 1 + 2 + 3 =	231	214	197	207	216	191	241

From the X-ray pictures of the wrists of individuals diagnosed as "normal for the age," the following average sums for the three indices have been deduced :—

	Girls.	Boys.
6 years	149	—
7 ,, ...	190	—
8 ,, ...	214	193
9 ,, ...	233	200
10 ,, ...	237	211
11 ,, ...	238	—
12 ,, ...	280	—
13 ,, ...	—	223
14 ,, ...	266	270

The following is a list of the cases. For reasons of reference they were arranged in alphabetical order, but the initials of the patients are omitted as being of no special interest to the reader. The abbreviations are : g. = girl, b. = boy, N. = normal, L. = late, E. = early, Bimax. cr. = bimaxillary crowding, Opist = opisthognathism. The figures in brackets give the average sum of the three beforementioned indices in normal individuals. In the column following the "normal index sum" the abbreviations are : L.N. = late skeletal development and normal eruption of permanent teeth, etc.

LIST OF CASES.

	Condition of apical base.	General state of growth.	Eruption of perm. teeth.	Sum of indices.	Normal index for same age.	Other points of interest.
1. b. 9 yrs.	N.	1 yr. late	2 yrs. early	201	200 L.E.	Indication of pseudo-epiphysis in Metacarp., I and II.
2. b. 7½ yrs.	N.	1 yr. late	½ yr. late	61	L.L.	
3. g. 9 yrs.	N.	0-1 yr. late	N.	166	233 L.N.	Anteroclusion.
4. b. 8 yrs.	Bimax. cr	1 yr. late	N.	118	193 L.N.	
5. g. 10 yrs.	N.	N.	N.	253	237 N.N.	
6. g. 8 yrs.	Bimax. cr	N.	N.	321	214 N.N.	
7. g. 7 yrs.	Bimax. cr.	N.	N.	192	190 N.N.	
8. g. 6 yrs.	Bimax. cr.	N.	1 yr. early	131	149 N.E.	
9. b. 8 yrs.	Bimax. cr.	1 yr. late	5 mths. late	82	193 L.L.	
9. b.10 yrs.	Bimax. cr.	1-2 yrs. late	1 yr. late	182	211 L.L.	
10. b. 7 yrs.	Opist.	0-1 yrs. late	N.	105	L.N.	Anteroclusion.
10. b. 7 yrs.	Opist.	0-1 yrs. late	N.	172	193 L.N.	
11. b.9½ yrs.	Bimax. cr.	2½-3½ yrs. late	½ yr. late	84	L.L.	Enamel defects, indication of pseudo-epiphysis in Metacarp., I and II, increments of growth in Radius.
11. b.11 yrs.	Bimax. cr.	3-4 yrs. late	1½ yrs. late	187	L.L.	
11. b.12 yrs.	Bimax. cr.	3-4 yrs. late		203		
11. b.12½ yrs.	Bimax. cr.	3½ yrs. late	1½ yrs. late	205	L.L.	
12. b.13 yrs.	N.	N.	2 yrs. late	223	233 N.L.	Increments of growth in Radius.
13. g.14 yrs.	N.	N.	N.	257	266 N.N.	Cross-bite.
14. b.8 yrs.	?	N.	N. (?)	170	193 N.N.	Extreme posterocl.
15. b. 9 yrs.	Maxillary cr.	N.	1 yr. late	191	200 N.L.	Cleft palate, enamel defects, indic. of pseudo-epiphysis in Metacarp. I.
16. g. 8 yrs.	Bimax. cr.	N.	1 yr. late	214	214 N.L.	
17. g. 7 yrs.	N.	0-1 yr. late	1 yr. early	194	190 L.E.	Posteroclusion.

	Condition of apical base.	General state of growth.	Eruption of perm. teeth.	Sum of indices.	Normal index for same age.	Other points of interest.
18. g. 9 yrs.	N.	N.	½ yr. late	235	233 N.L.	
19. b. 7½ yrs.	Opist.	½-1½ yrs. late	9 mths. late	146	L.L.	
19. b. 8½ yrs.	Opist.	½-1½ yrs. late	1 yr. late		L.L.	
20. b. 9 yrs.	Narrow vault	N.	2 yrs. late	193	200 N.L.	
20. b. 9½ yrs.	Narrow vault	N.	2 yrs. late	210	N.L.	
20. b.10 yrs.	Narrow vault	N.	1½ yrs. late	216	211 N.L.	
20. b.10½ yrs.	Narrow vault	N.		225		
21. g. 8 yrs.	Bimax. cr.	N.	1 yr. late	197	214 N.L.	
22. b. 6 yrs.	First N., later some crowdg.	0-1 yr. late	1 yr. late	48	L.L.	
23. g.10 yrs.	Bimax. cr.	2 yrs. early	1 yr. early	263	237 E.E.	
24. g.10 yrs.	Bimax. cr.	N.	1 yr. early	237	237 N.E.	
25. g.10 yrs.	Bimax. cr.	2 yrs. late	1½ yrs. late	193	237 L.L.	
26. b.10 yrs.	N.	2 yrs. late	N.	184	211 L.N.	
27. g. 7 yrs.	Narrow vault	N.	6-10 mths. late	186	190 N.L.	Enamel defects.
27. g. 8 yrs.	Narrow vault	N.		207	214	
27. g. 9 yrs.	Narrow vault	N.		218	233	
28. g.12 yrs.	Bimax. cr.	2-3 yrs. late	N.	204	L.N.	
29. b. 8 yrs.	Bimax. cr.	2 yrs. late	N.	61	193 L.N.	
29. b. 9 yrs.	Bimax. cr.	2-3 yrs. late	N.	108	200	
30. g. 6 yrs.	Bimax. cr.	N.	N.	184	149 N.N.	
30. g. 7 yrs.	Bimax. cr.	N.	N.	197	190	
31. g.10 yrs.	Bimax. cr.	2 yrs. late	N.	216	214 L.N.	
31. g.11 yrs.	Bimax. cr.		1 yr. early		238	
32. g. 9 yrs.	Narrow vault	N.	1-2 yrs. late	209	233 N.L.	
32. g.10 yrs.	Narrow vault	N.	2 yrs. late	217	237	
32. g.11 yrs.	Narrow vault	N.	2 yrs. late	229	238	
32. g.12 yrs.	Narrow vault		0-1 yrs. late			
33. b. 8 yrs.	Narrow vault	0-1 yr. late	½ yr. early	121	193 L.E.	
33. b. 8½ yrs.	Narrow vault			149		
33. b. 9 yrs.	Narrow vault	0-1 yr. late		171	200	
33. b. 9½ yrs.	Narrow vault	N.	15 mths. early	190		
33. b.10 yrs.	Narrow vault	N.	2 yrs. early	196	211 N.E.	
34. b.10 yrs.	Opist.	N.	1 yr. early	228	211	Rickets.
35. g. 8 yrs.	N.	N.	2 yrs. early	191	214 N.E.	Open-bite, enamel defects.
35. g. 9 yrs.	N.	N.	2 yrs. early	237	233	
35. g.10 yrs.	N.	N.	2 yrs. early	243	237	
36. b.10 yrs.	Narrow vault	N.	1½ yrs. late	219	211 N.L.	Open-bite, enamel defects, posteroclin.
37. g. 9 yrs.	Bimax. cr.	N.	10 mths. late	243	233 N.L.	
38. g. 6 yrs.	N.	N.	N.	87	149 N.N.	Increments of growth in Radius.
39. g.11½ yrs.	Bimax. cr.	N.	1½ yrs. late	226	N.L.	
40. b. 6½ yrs.	Bimax. cr.	2½-3½ yrs. late	1½ yrs. late	30	L.L.	Pseudo-epiphysis in Metacarp., II and I. General deficiency of growth.
40. b. 7 yrs. 10 mths.	Bimax. cr.	1 yr. 10 mths. to 2 yrs. 10 mths. late		87	193	Pseudo-epiphysis as before.
40. b. 8 yrs. 10 mths.	Bimax cr.	22 mths. late				
41. b. 8 yrs.	N.	1 yr. late	½ yr. early	53	193 L.E.	Pseudo-epiphysis in Metacarp., II.
41. b.10 yrs.	N.	0-1 yr. late	1 yr. early	159	211	
42. b. 7 yrs.	Bimax. cr.	1 yr. late	1½ yrs. early	65	L.E.	
42. b. 7½ yrs.	Bimax. cr.	½-1½ yrs. late	½ year early	94		
42. b. 8 yrs.	Bimax. cr.	1 yr. late	½ year early	131	193	
42. b.11 yrs.				184		
43. b. 9 yrs.	Bimax. cr.		1 yr. late	89	200 L.L.	
43. b. 9½ yrs.	Bimax. cr.	2½-3½ yrs. late	1 yr. late			
43. b.10 yrs.	Bimax. cr.	3 yrs. late		126	211	
43. b.10½ yrs.	Bimax. cr.	2½-3½ yrs. late	N.	144		
43. b.11 yrs.	Bimax. cr.	3 yrs. late	1 yr. late	169		
43. b.13 yrs.				232	223	
44. b. 9 yrs.	Bimax. cr.	1-2 yrs. late	N.	125	200 L.N.	
44. b.10 yrs.	Bimax. cr.	2-3 yrs. late		145	211	
44. b.10½ yrs.	Bimax. cr.					
44. b.11 yrs.	Bimax. cr.	1-2 yrs. late		172		
44. b.12 yrs.	Bimax. cr.			226		
45. g.11½ yrs.	Bimax. cr.	N.	N.	243	238 N.N.	Enamel defects, increments of growth in Radius.
46. g.11 yrs.	Opist.	N.	1 yr. late	255	238 N.L.	Cleft palate.
47. b. 9 yrs.	Bimax. cr.	1-2 yrs. late	N.	147	200 L.N.	Ossification island in capitatum.
47. b. 9½ yrs.	Bimax. cr.	1½ yrs. late		177		
48. g. 6 yrs.	Bimax. cr.	N.	N.	134	149 N.N.	
48. g. 7 yrs.	Bimax. cr.			177	190	
49. g. 9 yrs.	Bimax. cr.	N.	2 yrs. early	213	233 N.E.	
49. g.10½ yrs.	Bimax. cr.			238		
50. b. 6 yrs.	Bimax. cr.	1-2 years late	9 mths. early	Epiphysis ulnae multang. maj. and min. missing.	L.E.	Indication of pseudo-epiphysis in Metacarp., II, increments of growth in Radius.

	Condition of apical base.	General state of growth.	Eruption of perm. teeth.	Sum of indices.	Normal index for same age.	Other points of interest.
50. b. 7 yrs.	Bimax. cr.			Epiphysis ulnæ multang. maj and. min. missing.		
51. g. 7 yrs.	Narrow vault	N.	N.	212	190 N.N.	
52. g. 8 yrs.	Bimax. cr.	N.	$\frac{3}{3}$-1 yr. late	241	214 N.L.	
52. g. 9 yrs.	Bimax. cr.					
53. b.14 yrs.	Bimax. cr. Narrow vault	N.	1 yr. late	270	270 N.L.	Open-bite, enamel defects, increments of growth in Radius.
54. g. 5 yrs.	N.	1 yr. late	N.	103	L.N.	

1. The Relation Between Different Varieties of Apical Base Subdevelopment and Late or Early Skeletal Development.

As I have previously mentioned, orthodontists as a general rule seem to assume that malocclusions are purely local affairs, so to say, independent of any connection with the general condition of the body.* At most they have been considered as effects of some very early disturbance (Simon). But although the treatment has been performed by means of purely local manipulations, expansion of the arches, etc., in theory at least there has been the assumption that a defective development of the jaws has been the cause. As we can hardly believe that any orthodontist nowadays is in ignorance of the fact that the growth of the jaws, as all other growth, requires endocrine activity and consequently cannot possibly take place without it, how is it that operators have considered themselves capable of effecting an enlargement of the jaws by mechanical means?

There are two ways of explaining the capability of this local-mechanical method of effecting a result, of which it is known that it cannot be attained without the activity of an endogenous factor.

The first is a school of thought which reminds one of the old Natural Philosophy, and according to which crowding of the teeth is caused by something antagonistic to "Nature." After the crowding of the teeth has once begun, the anomalous condition is supposed to be increased. The "forces" which otherwise should "direct" the development towards a normal occlusion also of the permanent denture, are now active in a wrong direction. They become "perverted," that is, are active in a direction opposite the "intended" one. But if an expansion is performed at a sufficiently early age, the bad tendencies will be neutralised and the same forces will act in a favourable direction. These arguments are met with in Angle's writings.

Another hypothesis may be deduced from the writings of Howard. As was mentioned, he warned against starting a mechanical expansion of crowded dentures during a time when the X-ray examination indicates that the growth of the skeleton is in a period of relative stagnation. But where these examinations show a growth of the skeleton, an expansion is deemed good

* Exceptions are malocclusions which have been considered as results of certain habits or subnormal function. Much has also been made of the supposed connection with mouth-breathing. We are in this paper concerned with bimaxillary crowding, opisthognathism, etc., which appear to be related to a subnormal development of the maxillary or mandibular bases.

Fig. 5. Case No. 40. First permanent molars in occlusion.

Fig. 6. Case No. 40. Age $6\frac{1}{2}$ years. Wrist development $2\frac{1}{2}$ to $3\frac{1}{2}$ years late. Sum of indices = 30.

Fig. 7. Case No. 40. Age 7 years 10 months. 1 year 10 months to 2 years 10 months late. Sum of indices = 87.

Fig. 8. Case No. 40. Age 8 years 10 months. About 1 year 10 months late. Sum of indices = 143.

Fig. 9. Case No. 33. Age 8 years. 0 to 1 year late. Sum of indices = 121.

Fig. 10. Case No. 33. Age 8½ years. Sum of indices = 149.

Fig. 11. Case No. 33. Age 9 years. 0 to 1 year late. Sum of indices = 171.

Fig. 12. Case No. 33. Age 9½ years. Skeletal development normal. Sum of indices = 190.

Fig. 13. Case No. 33. Age 10 years. Skeletal development normal. Sum of indices = 196.

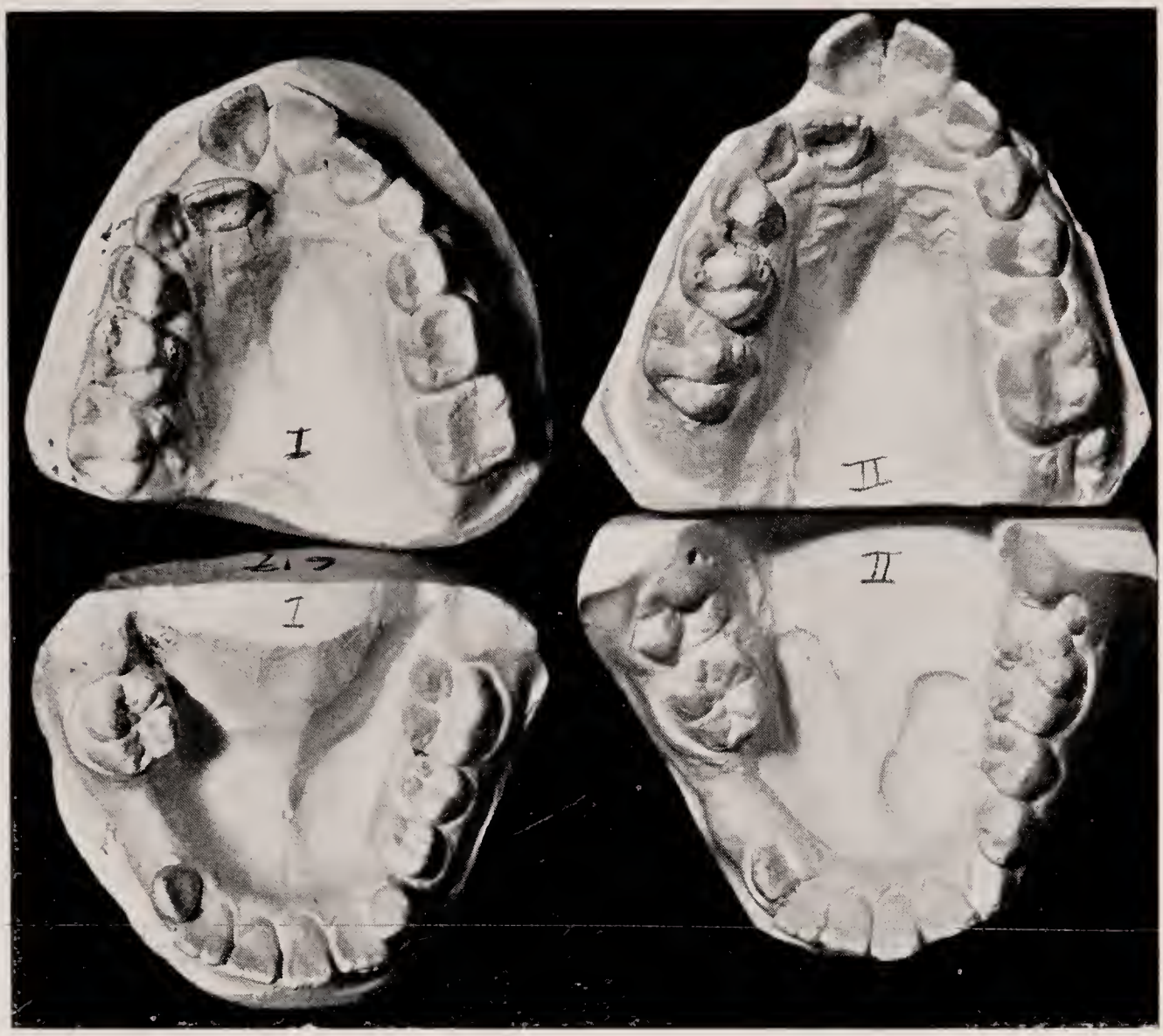


Fig. 14. Case 33. Age 8 years. Dentition 6 months early.

Fig. 15. Case No. 33. Age 9½ years. Dentition 1 year 3 months early.

Fig 16. Case No. 33. Age 10 years. Dentition 2 years early

practice. The correction of the crowding is accordingly effected by two different processes, firstly, a growth of the entire skeleton through physiological activity, and, secondly, by means of an orthodontic operation on the teeth with appliances. As Howard recommends the use of the latter it is clear that it is his opinion that without this mechanical treatment the crowding would remain. The endocrine secretion alone is consequently insufficient.

But now a very important question arises: what takes place in a case of crowding, when the endocrine secretion is normal, and accordingly the bones of the wrist grow at a normal rate, but no mechanical expansion of the arches is undertaken? The non-appearance of improvement as to the amount of space for the teeth would indicate that the skeleton in its entirety may grow without any correcting influence as to the position of the teeth. The objection may be made that a general growth of the skeleton may occur without at all influencing the apical bases to the effect that the crowding is relieved, and there have even been published cases where it was aggravated. It seems improbable that Howard was thinking of such cases, because if the jaws were unaffected in regard to the attainment of space for the teeth, then there would in reality not be any sense in taking the endocrine secretion into consideration when deciding the time for the orthodontic interference, unless we hold the opinion that no mechanically-effected orthodontic movement whatever be advisable, excepting during a period of active skeletal growth. But this can hardly be meant, as bone is plastic—that is to say, is subject to change of form under the influence of pressure and traction even after the skeleton is full-grown.

The only explanation of the motive for Howard's suggestion is, therefore, that a mechanically executed expansion of the arch ought to take place at the same time as a natural growth of the apical bases (or the alveolar processes, if we consider that these may undergo a change providing better space for the teeth without the bases themselves changing form). But if this general growth of the jaws does not take place at the same time or shortly after, then the mechanical expansion is without result or even injurious. If we limit ourselves to what seems to be obvious from our clinical experience, this rule for treatment appears to be good from the standpoint of our professional reputation. We have all expanded crowded dentures with results varying from O to some distance in the direction of the ideal. What is then more natural than to endorse the conclusion of Hellman,[11] that the general growth of the jaws has also varied between both these extremes, and that the proximity of the result to the ideal is in direct proportion to the general growth?

Howard recommends expansion of crowded dentures in cases where series of X-ray pictures of the wrist indicate a favourable skeletal growth. This can hardly mean anything else than that the base grows during the mechanical treatment, or perhaps shortly after. But as this latter growth partly (or totally, which seems more probable) is a result of endocrine activity, then it ought to be possible to detect *some* change indicating growth also where no mechanical treatment has been executed.

If a crowding of the teeth is to be regarded as a symptom of

faulty sketelal growth, then an improvement in the latter ought in a case of this kind of anomaly to be followed by an improvement in the position of the teeth. If this latter improvement does not appear in a case in which a series of X-rays show a normal rate of growth, then the conclusion is that *remaining of the crowding may be independent of any retarding of the general growth.* However, a case like that is no counter-evidence against a possible connection between an endocrine disturbance and the crowding during a much earlier period long before the examination was made.

As is seen from the list of cases (page vi), the state of wrist development and dentition are divided into three classes—early, normal and late. This gives nine possible combinations. At the first examination of the patients the division gave the following :—

		General development.	Dentition.	
Group	1 ...	normal	normal	10 cases
,,	2 ...	late	late	8 ,,
,,	3 ...	early	early	1 case
,,	4 ...	late	normal	10 cases
,,	5 ...	late	early	6 ,,
,,	6 ...	normal	early	5 ,,
,,	7 ...	normal	late	14 ,,
,,	8 ...	early	late	— ,,
,,	9 ...	early	normal	— ,,
				54 ,,

As is seen from the list, several modifications occurred later.

The different varieties of subdevelopment in the region of the apical base are distributed as follows :—

	Normal base.	Bimaxillary crowding.	Narrow palate.	Opisthognathism.
Group 1. (N.N.)	4	5	1	—
,, 2. (L.L.)	1	7	—	—
,, 3. (E.E.)	—	1	—	—
,, 4. (L.N.)	3	6	—	1
,, 5. (L.E.)	3	2	1	—
,, 6. (N.E.)	1	3	—	1
,, 7. (N.L.)	2	6	3	3
	14	30	5	5

If the crowding of the teeth is to be considered as a result of a general growth disorder, it seems to be an obvious conclusion that this disorder is a retardation. The size of the teeth is predetermined, but the jaws are too small, accordingly the jaws have not had time to grow sufficiently to provide space for the permanent teeth. We would consequently expect a retarded development of the wrist in cases of bimaxillary crowding. The thirty cases show :—

Early development in 1 case.
Normal ,, ,, 14 cases.
Late ,, ,, 15 ,,

If the development of the wrist is to be taken as a reliable

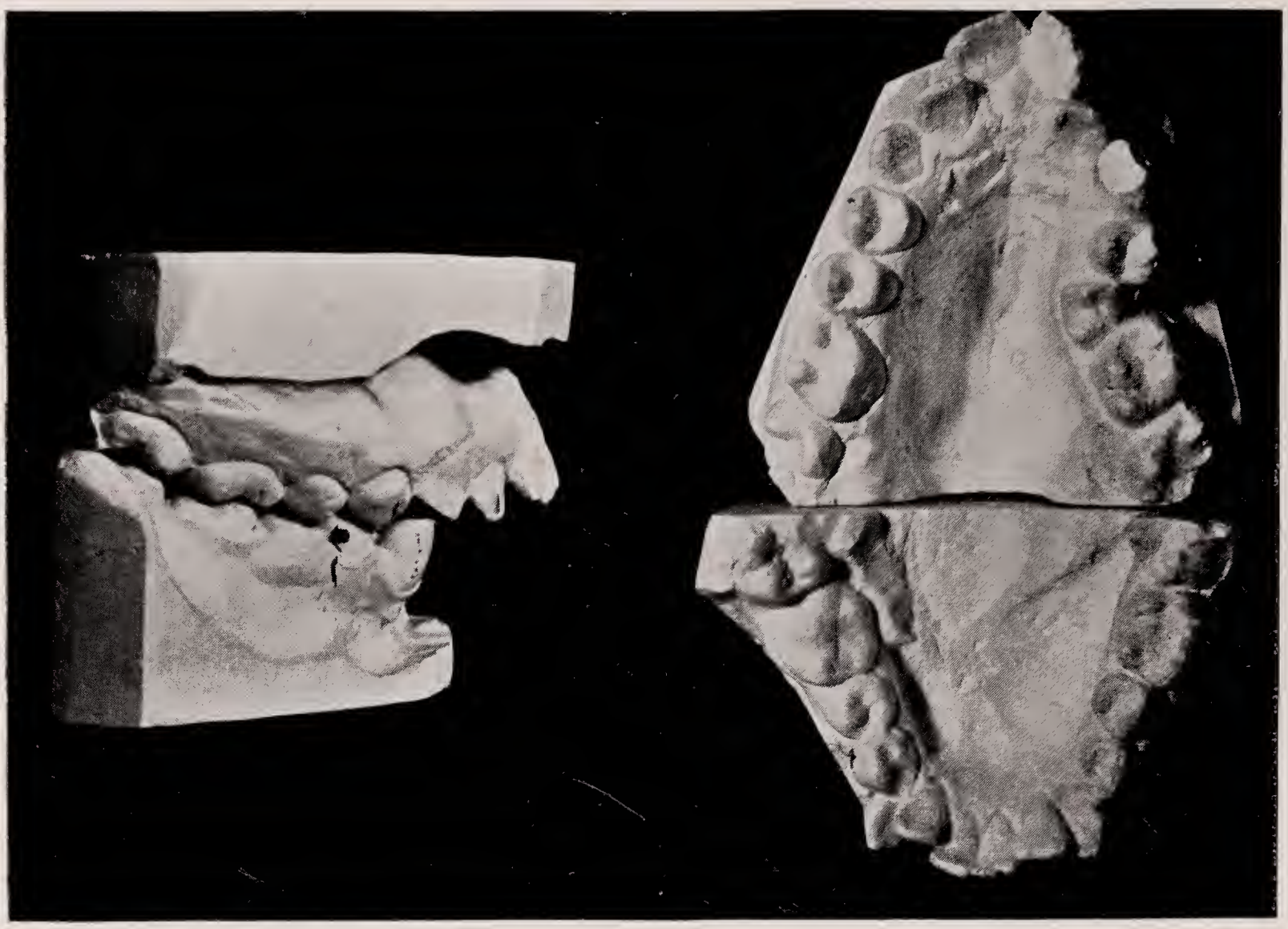


Fig. 17A.

Fig. 17B.

Fig. 18.

Fig. 19.

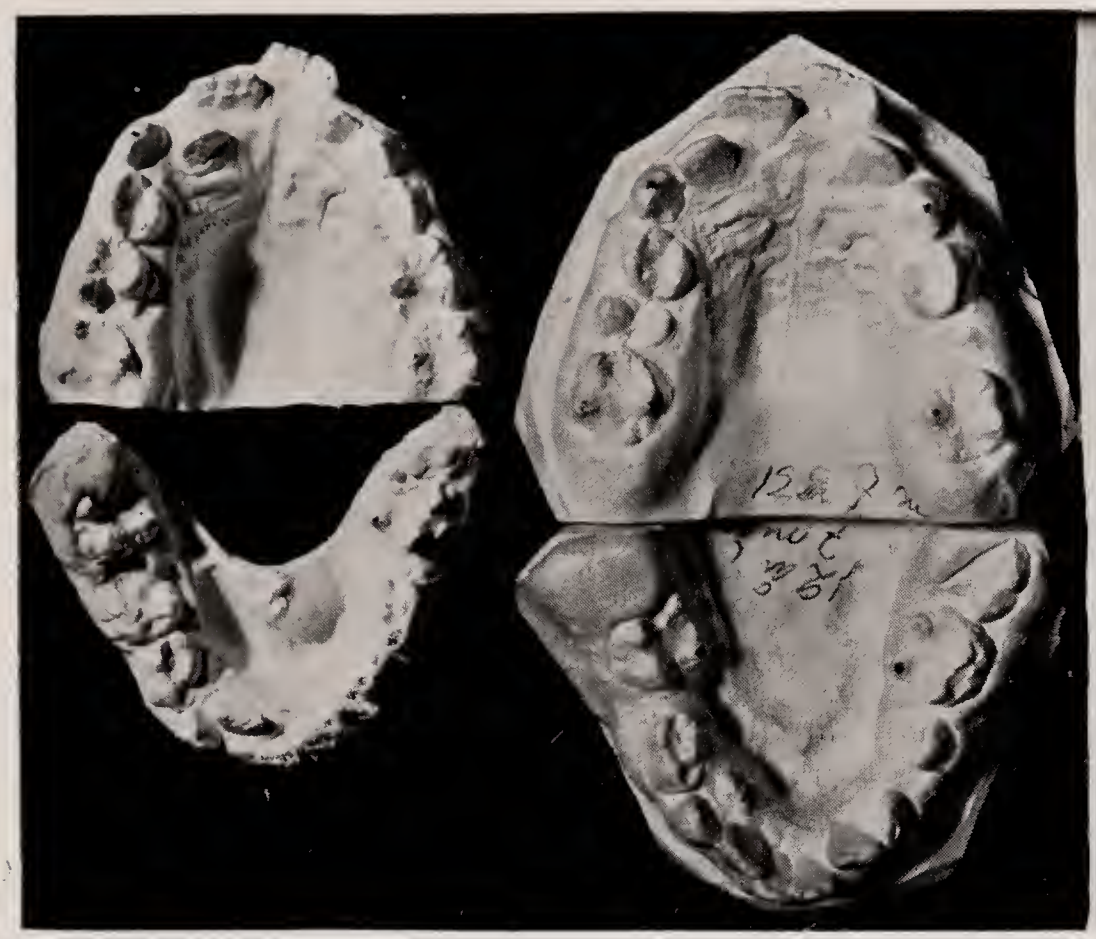


Fig. 20. Case No. 11. Dentition $\frac{1}{2}$ year late. Wrist developed $2\frac{1}{2}$ to $3\frac{1}{2}$ years late (see Fig. 22). Age $9\frac{1}{2}$ years.

Fig. 21. Case No. 11. Dentition $1\frac{1}{2}$ years late. Wrist development $3\frac{1}{2}$ years late (see Fig. 25). Age $12\frac{1}{2}$ years

Fig. 22. Case No. 11. Skeletal development $2\frac{1}{2}$ to $3\frac{1}{2}$ years late. Sum of indices = 84. Age $9\frac{1}{2}$ years.

Fig. 23. Case No. 11. Skeletal development 3 to 4 years late. Sum of indices = 187. Age 11 years.

Fig. 24. Case No. 11. Skeletal development 3 to 4 years late. Sum of indices = 203. Age 12 years.

Fig. 25. Case No. 11. Skeletal development $3\frac{1}{2}$ years late. Sum of indices = 205. Age $12\frac{1}{2}$ years.

indication of the general endocrine condition, the conclusion must be that bimaxillary crowding during the age which concerns us in this connection is not necessarily a symptom of a general subdevelopment, as retardation was only to be found in 50 per cent. of the material. Retardation was, however, nearly as common as normal development, and considerably more common than early development, which was found only in one case.

It seems remarkable that in this material the deviations from normal development were so common. The development of the bones of the wrist was normal for the age in twenty-nine cases, and deviated in twenty-five cases. Even if we exclude from the latter as uncertain the five cases diagnosed by Dr. Lysholm as "0-1 year late," we still have left twenty cases out of fifty-four, or 37 per cent.

The cases with normal apical base were fourteen. Of these only seven were quite normal as to the development of the wrist. If we also here count as normal "0-1 year late," we have nearly the same deviations, 36 per cent.

It is evident that the clientele of the orthodontic department contains a larger average percentage of cases of bimaxillary crowding than would be found if whole classes of children had been examined. The patients of the department in question apply for advice or treatment for cases of malocclusion, and although to my knowledge we have no statistics of the frequency of bimaxillary crowding in Swedish schools, it seems from other reports as if this anomaly is one of the most common malocclusions. In my material, normal apical base was found in thirteen cases.

From the list of cases we may draw the following conclusions. The skeletal development was in cases of :—

Normal apical base.	Bimaxillary crowding.
Early in 1 case = 3%	Normal in 14 cases = 46%
Normal in 6 cases = 46%	0-1 year late in 2 cases = 6%
0-1 year late in 2 cases = 15%	1 year late in 3 cases = 10%
1 year late in 4 cases = 31%	1-2 years late or more in 10 cases = 36%
2 years late in 1 case = 8%	

The skeletal development was normal in the same proportion (= 46%) in both the normal and the crowded base, but otherwise the tendency towards a higher degree of retardation (1-2 years late or even more) was somewhat greater in the cases of crowded apical base.

Different Varieties of Apical Base Subdevelopment and Late or Early Dentition.

In accordance with Josefson's theory that the dentition is dependent on the endocrine secretion, which he has also confirmed in practical cases where the administration of endocrine preparations was followed by a rapid shedding of the temporary and a rapid eruption of the permanent teeth, we would expect a relative retardation in cases with subdeveloped apical base—that is, provided this latter condition, according to Howard's directions for treatment, may be in some connection with an endocrine disturbance. We find that in my material the dentition was in cases of :—

Normal apical base.		Abnormal base.	
2 years early in 2 cases $\frac{1}{2}$-1 year early in 2 cases	= 30%	2 years early in 1 case 1-1$\frac{1}{2}$ years early in 4 cases	=23%
Normal or slightly retarded in 6 cases = 46%		$\frac{1}{2}$-$\frac{3}{4}$ year early in 2 cases Normal in 11 cases	=36%
$\frac{1}{2}$ year late in 2 cases 2 years late in 1 case	= 24%	$\frac{1}{2}$-1$\frac{1}{2}$ years late in 12 cases	=40%.

From which we find that the tendency towards a retardation is somewhat greater in the subdeveloped cases. The occurrence of an early dentition in similar cases was, however, remarkably great. This would be rather astonishing if crowding of the teeth were a symptom of retarded development. A retarded eruption of permanent teeth in cases of crowding may be to some extent a local result of lack of space. The clinical observation may frequently be made that the eruption of the permanent teeth is taking place quite normally with the exception of some detail, as when a single upper temporary cuspid has been shed, and an X-ray examination will show a topographically inconvenient position of the successor. However, the common occurrence of early and normal eruption in cases of subdeveloped apical base indicates that *these malocclusions may have some other cause than a general endocrine disturbance,* and are consequently in no respects to be considered as symptoms of any such disturbance.

Relation between the Lateral Growth of the Dental Arches and the Skeletal Growth.

In his "Variations of the Form of the Jaws," Dr. J. Sim Wallace[9] has published some figures of what may be considered as a fair example of the normal lateral growth of the dental arches. I have made similar measurements of two cases of my own (Cases I and II) and give them here, accompanied by Dr. Wallace's case. The amount is given in millimetres.

	Intercanine		Inter m.1 or pm.1		Inter m.2 or pm.2		Inter m.1	
Years.	max.	mand.	max.	mand.	max.	mand.	max.	mand.
Case I.								
From 5-17$\frac{5}{6}$	8.2	6.5	—	—	9.0	6.5	—	—
,, 9$\frac{1}{3}$-17$\frac{5}{6}$	—	—	—	—	—	—	3·5	3·5
Case II.								
From 4-19	6.0	5·5	—	—	5·0	5·0	—	—
,, 8$\frac{1}{2}$-19	—	—	—	—	—	—	3·5	2·5
Wallace's Case.								
From 3$\frac{1}{2}$-9$\frac{1}{4}$	3·5	2·3	2.2	1.0	2·5	0.8	—	—
,, 7$\frac{1}{2}$-19	0.7	0.6	1.6	2·5	2·7	1·7	1.2	–0.6

In the same work by Dr. Wallace are also published accounts by other authors of the lateral growth of the arches. It seems apparent that some lateral growth is to be expected in normal cases.

The amount of lateral growth in thirteen cases of different varieties of subdevelopment of the apical base are given here. Anyone interested can easily find other particulars in the list of cases on page vi. For comparison, Cases I and II (normal cases) are given at the end of the list.

LATERAL GROWTH IN SOME CASES OF CROWDING.

Case

11. Bimax. cr. During $9\frac{1}{2}$-$12\frac{1}{2}$ years $2\frac{1}{2}$-4 years' retardation in the wrist, but with normal growth during this time. During $9\frac{1}{2}$-11 years $1\frac{1}{2}$ years' late dentition. From 9-$10\frac{1}{2}$ years and intercanine mandibular growth of +0.5, maxillary +2 mm. Inter. M.1 mand. and max., from 9-$12\frac{1}{2}$ years = 0.

19. Opist. From $7\frac{1}{2}$-$8\frac{1}{2}$ years $\frac{1}{2}$-$1\frac{1}{2}$ wrist retardation, normal growth during the time, and $\frac{3}{4}$-1 year retard. dentition. Mand. intercanine growth = 2 mm. Max. d:o = 1 mm. Inter M.1, mand. and max. = 0.

24. Bimax. cr. From 10-11 years wrist normal, dentition at 10 years 1 year advanced. No lateral growth of the arch.

27. Narrow vault. 7-9 years wrist normal. Dentition $\frac{1}{2}$-5/6 years later. Intercanine mandibular growth 7-9 years = +2 mm., in other regions = 0.

29. Bimax. cr. Wrist at 8-9 years 2-3 years late, with hardly normal growth during the year. Dentition normal. Intercanine mand. and max. growth = +1 mm., in other regions = 0.

32. Narrow vault. Wrist normal. At 9 years 1-2 years late dentition. Inter. M.1 mand. growth 9-11 years = +1.5 mm., in other regions = 0.

33. Bimax. cr. Wrist 8-9 years = 0-1 year late, but with normal growth during the time. At $9\frac{1}{2}$ and 10 years the development of the wrist had come in line with the age. Dentition: at 8 years = $\frac{1}{2}$ year in advance; at $9\frac{1}{2}$ = 1 year 3 months early and at 10 = 2 years in advance; from 8-10 years no lateral growth.

42. Bimax. cr. Wrist 7-8 years = $\frac{1}{2}$-$1\frac{1}{2}$ year late, but with normal growth during the year. Dentition $1\frac{1}{2}$ year early. Mand. intercanine and inter. m. = 1 mm.; max. intercanine = 1.5 mm.; in other regions = 0.

43. Bimax. cr. Wrist at $9\frac{1}{2}$-11 years $2\frac{1}{3}$-3 years late, normal growth during this time. Dentition: 1 year early; lateral growth $8\frac{1}{2}$-11 years: intercanine mand. = +3 mm., intercanine max. = +2 mm., inter. m. 1 mand. = + 1mm., d:o max. = 0.5 mm.

44. Bimax. cr. Wrist at 8-9 years 2-3 years late. Dentition normal. Lateral growth 9-10 years in max. and mand. canine region = +1 mm., in other regions = 0.

47. Bimax. cr. Wrist 9-$9\frac{1}{2}$ years 1-2 years late but with normal growth. Dentition normal. 9-$9\frac{1}{2}$ years intercanine mand. lateral growth = +1 mm., max. d:o = 0, inter. m.2 (max.) = +2 mm., inter. M.1, mand. and max. = 0.

50. Bimax. cr. Wrist 6-7 years 1-2 years late, with normal growth during the time. No lateral growth in the premolar and molar region, in the canine region = 1 mm.

52. Bimax. cr. Wrist at 8-9 years normal. Dentition $\frac{2}{3}$-1 year late. Intercanine mand. growth = 2 mm., in other regions = 0.

To facilitate a survey of the lack of lateral growth in the approximate ages a summary is given here. The lateral growth was :—

Case.	During the years	Intercanine mandibular.	Intercanine maxillary.	Inter M.1 mandibular.	Inter M.1 maxillary.	Skeleton growth.
11	9–$10\frac{1}{2}$	+0.5mm.	+2 mm.	0 mm.	0 mm.	late
11	9–$12\frac{1}{2}$	0	0	0	0	
19	$7\frac{1}{2}$–$8\frac{1}{2}$	+2 ,,	+1 ,,	0	0	late
24	10–11	0	0	0	0	normal
27	7–9	+2 ,,	0	0	0	normal
32	9–11	0	0	+1.5 ,,	0	normal
33	8–10	0	0	0	0	late
40	$6\frac{1}{2}$–7, 10 months		−0.5 ,,	—1.5 ,,	0	late
42	7–8	+1 ,,	+1.5 ,,	0	0	late
43	$8\frac{1}{2}$–11	+3 ,,	+2 ,,	+1 ,,	+0.5 ,,	late
44	9–10	+1 ,,	+1 ,,	0	0	late

Case.	During the years	Intercanine mandibular.	Intercanine maxillary.	Inter M.1 mandibular	Inter M.1 maxillary.	Skeleton growth.
47	9–9½	+1 mm.	0 mm.	0 mm.	0 mm.	late
50	6–7	+1 ,,	+1 ,,	0	0	late
52	8–9	+2 ,,	0	0	0	normal
29	8–9	+1 ,,	+1 ,,	0	0	late
Normal case.						
I	9⅓–11	+2 ,,	+2 ,,	+2 ,,	+0.3 ,,	
II	9 5/12-10 5/6		+2 ,,	+1 ,,	+1 ,,	

As an example we may give Case 33 (Figs. 9-16). At 8 and 9 years the general development was slightly behind. The dentition was at 8 years half a year advanced, and was accelerated compared with the general development, so that it was two years early at 10 years. The general growth also became accelerated after 9 years and was at 9½ and 10 years normal for the age. In spite of this acceleration of growth and development, visible both in the wrist development and the eruption of the permanent teeth, there was no lateral growth of the dental arch between the eighth and tenth year. It was a case of narrow vault and slight bimaxillary crowding, an anomaly that was not influenced by the brisk general growth, provided that a lateral growth in the molar region be considered as normal for the age in question (8-10 years).

The other cases on page xviii corroborate this. Of these, two-thirds exhibited a retarded development of the wrist. But the periodical examinations of the region in question gave evidence of a normal development for the intervals of time between the different examinations. The insignificant or absence of lateral growth during the same time can therefore not be associated with any general growth disturbance.

The Case No. 40 was a pathological case of subnormal endocrine secretion requiring medical treatment. The result is shown in Figs. 6-8. As is seen, the skeleton has grown. But the dental arch did not exhibit any lateral growth (Figs. 3, 4, 5) : the lateral width of the arch had slightly decreased.

The retardation of growth in the nine cases was not considered as of sufficient importance to require any medical treatment.

Conclusions.

The starting-point of this investigation was Clinton Howard's theory that an expansion of a crowded arch ought not to be attempted before the operator felt assured that the general growth of the patient was in a state of activity. If the X-rays of the wrist gave evidence that this was not the case, an orthodontic treatment might even do harm. This theory presumes that the treatment of crowded arches ought to be regarded as a part of a struggle aiming at enlarging a part of the human body. During a period of active growth this is supposed to be possible, that is to say, by means of mechanical appliances we are able to effect an increase in size, which would not have occurred without these appliances.

I believe my cases indicate that a considerable number of cases

of bimaxillary crowding are accompanied by a retardation of the skeletal growth. But in every one of these cases a growth occurred during the time elapsing between the different X-ray examinations, and this growth was normal for the periods in question. But in many cases there was no lateral growth in the arches.

Accordingly, it seems as if in these cases the objective of the orthodontic treatment cannot be an increase in the amount of bone. It will instead aim at a correcting of the positions of the teeth without any thought of an enlargement. The most suitable age for treatment will be selected according to the amount of damage that may be a result of the malocclusion at the time of the examination and not from any idea that growth is more active at an earlier age than later. If, as often happens, the malocclusion is doing damage, it must be treated accordingly. But if this is not the case it would seem more sensible to wait until the operator has got a more definite idea of the type of apical base the case finally will exhibit.

In my experience cases like Figs. 17 and 18 cannot be treated with success by the Angle school methods, however early the treatment is started. In my opinion, the explanation is simply this, that the anomaly is not a curable local insufficiency of growth, but a change of type. In these cases orthodontics is not so much to be regarded as effecting growth as changing form.

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Discussion.

The President said the paper was a very scientific one, but at the same time it was full of common sense and practical details.

Dr. Friel, in opening the discussion, said he wished first to tell Dr. Lundström how much the members of the Society appreciated his coming to this country to give them the results of several years of research work. The paper which Dr. Lundström had just read was, like all his papers, worth reading again and again. Twenty-five years ago orthodontists were a much more self-satisfied race than they

were at the present time. They knew then or thought that they knew, the nature and ætiology of all malocclusions, but people like Professor Brash came along and upset all their notions and said that they had no evidence to support their various theories. Those theories might or might not be right; the main thing that Professor Brash said was that there was no evidence to support them. Now Dr. Lundström came along and said that Clinton Howard's theory, that it was not wise to expand a crowded arch when there was endocrine disturbance, was wrong. Dr. Lundström made it clear that the resumption of active growth of the long bones had no counterpart in the growth in the width of the jaws. Was Howard justified in drawing a comparison between two such different types of bone as bone developed in cartilage and bone developed in membrane? Howard took a cartilaginous bone such as the ulna and compared it with a membranous bone such as the jaws. It also had to be remembered that the two bones he was comparing were growing at very different rates. The long bones were growing in inches, whereas the lateral growth of the jaw was, at the maximum for the whole period, 4 or 5 mm. The majority of the cases examined by Dr. Lundström were between 9 and 11 years of age; that was his average age. The average growth in the normal individual would be only about 1 mm. during that period. Going over Dr. Lundström's figures the average growth, as far as he could make out, was 1 mm in the lower intercanine region, much less in the upper intercanine region, and very much less in the molar region. A considerable amount of the lateral expansion occurred before 8 years of age, and he thought that Dr. Lundström's investigation might have been of greater value if he could have obtained the children at a younger age, say between 5 and 7, rather than between 9 and 11. There was one other point he would like to mention to show that it might not be desirable to compare cartilaginous bones and membranous bones. In the condition of achondroplasia there was an arrest of growth of the cartilaginous bones. The bones that formed the base of the skull were developed in cartilage and remained small all through life, whereas the brain went on growing and it had to be accommodated by the greater growth of the vault of the skull, which was a bone developed in membrane. Therefore in achondroplasia there were two types of bone growing in quite different ways. Last May Mr. Chapman and he had the opportunity of examining a large collection of skulls in the anatomical museum in Amsterdam, and they obtained some information as to the method by which the permanent incisors were able to assume correct alignment. The permanent incisors before they erupted were in an exceedingly cramped position. The lateral incisor was tucked in behind the central incisor, and one wondered how they ever could disentangle themselves. One method of assuming correct alignment was by lateral expansion between the canines. That was shown either by increase of space between deciduous incisors or by increased intercanine breadth. The spacing might not be evident in the mouth, as the spacing could take place in the root area. A distinction had therefore to be drawn between root and crown spacing and root spacing alone. Mr. Chapman and he saw a great many skulls showing root spacing. It could be seen how the roots diverged from one another, with the cutting edges of the incisors together. He showed a slide of the skull of a young chimpanzee. It could be noticed that, especially in the case of the lower lateral and central incisors, the roots were almost parallel. Another slide showed the skull of an older chimpanzee. The deciduous incisors were all slanting towards the centre. The amount of wear of the incisal edges of the

crowns and the small amount of crown showing above the gum line would make it difficult to detect this root spacing in the living animal. The second method was by the direction of eruption of the permanent incisors in relation to the position of the deciduous incisors. The permanent incisors came forwards and downwards, and the further they came down the further out they came, and so they occupied a larger arc of a smaller circle. The reason why the laterals were enabled to come forwards and downwards was that, as the permanent central came downwards, it exposed a narrower part of its surface to the lateral, so that the latter was able to slip forward and come down. Once the incisors were down they did not seem to alter in a crowded arch, no matter what growth there might be, and he could not see any reason why they should alter. The reason for any growth had gone. Professor Harris had recently published a book, "The Growth of Bone in Health and Disease," in which he showed that there were marks on the long bones indicating arrested development. He wrote to Professor Harris and asked him whether the long bones ever recovered completely in length. Professor Harris mentioned in his book that the arrested growth also occurred in the membranous forms but there it was not evident, because the growth occurred over the surface. Professor Harris, in his reply, said that he thought there was an attempt to return to the normal, and he gave as an example that when people were convalescent there was an increase in length of the long bones, which in that way recovered. Professor Harris also mentioned fractures, but they were really outside normal growth, and he did not think the theory applied in that case. Taking Dr. Lundström's paper and the other papers that he had written, it was evident that he did not consider that treatment by orthodontic appliances could in any way influence the apical base. Acceptance of that conclusion, if abnormal apical bases were as frequent as Dr. Lundström considered them to be, involved an attitude of pessimism and almost of despair in orthodontics. He preferred to state his own attitude as follows. Orthodontists had evidence in some at any rate of their failures that they could not influence the apical base to an unlimited extent by mechanical treatment, and indeed they sometimes saw an abnormality of its form increasing while their treatment was in progress. The proportion of successful treatments, however, was undoubtedly much greater than the proportion of self-correcting malocclusions, even when malocclusions of local origin were left out of account, and he could only deduce that they did in the less marked abnormalities alter at least the form of the base so that it could support the teeth in regular order. It must be remembered that the only definition that could be given of the normal apical base was "that base which can support the teeth in a normal arrangement." Further, he believed that the reduction of pressures to the extremely low amount that was now known to be desirable and the continuity of action which could be attained were making the mechanical treatment undertaken by orthodontists very much more effective than it had been in the past. He wished to thank Dr. Lundström for his most interesting paper. Dr. Lundström was the father and brother of European orthodontists.

Mr. Harold Chapman said the present was the third occasion on which Dr. Lundström had visited the Society to present a communication, and each one had been a valuable and important contribution to orthodontics. In his present work Dr. Lundström had continued his investigations into the problem of the apical base, which he (the speaker) regarded as one of the foundation-stones of orthodontics. He agreed with Dr. Lundström's conclusions, although perhaps he

arrived at agreement by a different process of reasoning, and in one particular he disagreed with the interpretation which Dr. Lundström put on his data. He mentioned that because he thought that one of the most important pieces of research work in orthodontics was to discover what changes occurred in the arch breadth of untreated abnormal cases. Dr. Lundström had begun that work, and, so far as he knew, was the only worker who had reported any advance at all in that direction ; so he hoped that he would continue to watch the particular cases he had been observing and publish results at a future date. The cases reported that evening exhibited very little increase in arch breadth. To the speaker, bimaxillary crowding conveyed the idea that the jaws were not large enough to contain the teeth in good alignment. The alignment was a positive, exact guide to the normality of size of the jaws. If alignment was good the jaws were well developed : if it was not, the jaws were too small. For the purpose of the present discussion he was presuming that the teeth were the correct size ; that, he thought, was an important point. No other bones provided such a guide to normality or abnormality of development ; the least degree of insufficient development of the jaws must result in irregular teeth. When he said " insufficient development " he meant an under-development which could never be recovered so that all the teeth could get into good alignment, and he thought that was what Dr. Lundström meant by retardation ; he did not think Dr. Lundström meant only delay. In any other bones a slight degree of insufficient development could not be detected, and it could not be detected in the jaws except by the teeth, but these permitted the slightest degree of insufficiency to be diagnosed. Therefore he did not think too much stress should be put on the fact that the jaws might be under-developed when considering growth of the whole body ; the other bones might be equally under-developed, but such under-development might not be apparent. Miss Clinch had shown, in a paper which she had read before the Society two years ago, that insufficient development might occur before birth, and it might occur, as Dr. Friel had stated, after birth, owing to certain conditions, perhaps of the thyroid, as Dr. Lundström had mentioned. He wanted to turn for a moment to another aspect of the subject. Normal arches increased in breadth from before 5 years of age up to 12 years, i.e. during eight years. The time was probably longer, but he did not wish to exaggerate at all. There was no information whether that occurred in abnormal arches except that provided by Dr. Lundström, and, in his opinion, Dr. Lundström's measurements had not the value that he would attach to them had they been taken over a longer period. He agreed with Dr. Friel that the time was too short. If Dr. Lundström's cases were analysed, it would be found that ten out of thirteen showed an increased deciduous canine breadth even in the short period in question. If the period had been longer, he thought the increase would have been greater. Two of them showed increased molar breadth, and the remainder showed no increase in molar breadth. The arches might be widening even though the molars showed no increased arch breadth, because when the second deciduous molars were lost there was a forward movement of the permanent molars, and that forward movement took place along converging lines. Therefore any increased width due to growth was neutralised by the forward movement along these two lines. Therefore he thought the preponderance of evidence, which Dr. Lundström's cases supplied, was that the arch breadth was increasing in the abnormal cases presented by the essayist. He believed that at the most in normal cases the arch breadth increased 2 to 3 mm. in the upper and 1 to 2 mm. in the

lower, during the age period 5 to 12 years ; that was only 10 per cent. and 5 per cent. of the whole, yet there would be an increase of 50 per cent. in the height of the child and an increase in weight of 100 per cent. in the same period. Therefore, if increase of arch breadth was used as a method of estimating whether general growth was taking place, a factor was employed which in normal cases showed such a small increase, that he did not think it fair to use that factor alone (when others were available) unless the most accurate measurements could be made. A very slight disturbance of bone growth was likely to affect any deductions that might have been made. Therefore he was of the opinion that increase of arch breadth was not a satisfactory method of estimating whether general growth was taking place normally, although he thought it was probable that growth would be shown to take place in the majority of abnormal cases with small arches. If the dental arches were to be used as a criterion of general growth it might be better to use the length of the arch, because it was known that the arch increased in length a great deal more than it increased in breadth ; that method seemed to be open to a smaller degree of error, although he could foresee objections to it. Briefly he interpreted Dr. Lundström's conclusions according to the following table :—

Growth of Skeleton			Growth of Apical Base Masticatory Face	Alignment of Teeth
At birth	+ After birth	=		
Normal	Normal		Normal ⊙	Good
Insufficient	Normal		Small ⊙+	Irregular
Insufficient	Insufficient	* Pathological	Very small ⊕‡	Very Irregular
Normal	Insufficient	* Pathological	Normal at Birth ⊕ subsequent growth insufficient	Irregular

⊙ X-rays of wrist show growth

⊕ X-rays of wrist show deficient growth: No growth of apical base after birth

✳ Uncommon cases: signs of deficient bone growth elsewhere

† Typical class I case
‡ Severe class I case
} Prognosis as regards enlargement of arches by treatment not good

⊙† Should show increased arch breadth e.g. Lundström's case 43. Patient's health good

If the growth of the skeleton was normal, both before and after birth, then a normal masticatory face and apical base resulted and the alignment of the teeth was good. But if, either before or after birth, the growth of the skeleton was insufficient, he imagined that there would be a small apical base and irregular teeth. If it was insufficient both before and after birth, then he thought the masticatory face would be very small and the teeth very irregular. The speaker could not conceive that such lack of growth at the proper time could be made up later. The speaker showed on the screen the models of two dwarfs, one with very irregular teeth, which were extremely crowded, and the other with a beautiful set of teeth. It seemed to him that, whilst as a general rule one expected under-development to affect the body as a whole, there might be exceptions. The teeth of the dwarf with the perfect set of teeth were slightly below the average size, but they were not smaller than the average to the same degree as his

body was below the average size. This seemed to point to the conclusion that development of the body as a whole was not necessarily a criterion of the development of the masticatory face or *vice versa*. There was one point in Dr. Lundström's paper about which he was not very clear, and perhaps Dr. Lundström would be able to explain it. He spoke in the paper of normal, early and late development. He imagined that by early development Dr. Lundström meant that the jaw attained its full size at a rather early age, and that by late development he meant that the jaw was slow in development and late in reaching its full size. If that was what Dr. Lundström meant, he was not at all sure that it had any real significance to orthodontists, except that they should bear in mind, when making a diagnosis, that such things might occur. Slides were shown of a girl who at 7 or 8 years of age had crowding of the lower incisors, the arch being apparently too small, but at 14 or 16 years of age she had a beautiful arch without any irregularity at all. Was one to say that the teeth had erupted too early or that the apical base had developed too late ? Whether the base developed early or late did not seem to him a matter of great importance. He would like Dr. Lundström to explain the point, because he feared that he had not got the correct interpretation. He gathered that some cases of bimaxillary crowding had normal apical bases. He would like Dr. Lundström to state how he diagnosed those apical bases and also what was his explanation of the condition, i.e. the crowded teeth in the normal apical base. He felt, as he imagined Dr. Lundström felt, that X-rays of the wrist were not a very good index of skeletal growth, and he would like to ask Dr. Lundström whether it would not be just as useful and practical to use the height and weight of the child as an index. He agreed with Dr. Lundström's general conclusions that orthodontic treatment could not increase the amount of bone and that in many Class I cases it was better to confine treatment to alignment of the teeth. In other words, as Dr. Lundström said, orthodontics was very largely a question of change of form : except in slight cases, Class I (insufficiency of bone) might be treated best by extraction, but Class II and Class III cases, in which errors of form predominate, might be treated without extraction, unless there was a much diminished apical base, which implies insufficient bone to contain the teeth in alignment. He summarised his remarks by saying, dental arch development may be abnormal before or after birth, or both : in neither case can it correct itself, and it will always be diagnosable by irregularity of the teeth. Dental arches, abnormal (small) at birth, will increase in size after birth just as normal ones do, but they may not do so (just as arches normal at birth may not) if some factor prejudicial to bone growth comes into operation ; it is these in which growth is *not* normal after birth that the speaker suspects are the ones which will exhibit abnormal wrist development, and this would account for the divergence in Dr. Lundström's findings and explain those cases which did not show increased arch at the time it was to be expected. He wished to express his appreciation of Dr. Lundström's work and to thank him for visiting the Society and reading his paper before it.

Miss Smyth thanked Dr. Lundström very much indeed for his paper and in particular for calling attention to and illustrating a problem which must have puzzled all orthodontists, i.e. the correlation, if any, between the general development of the individual and the development of the jaws in particular. She wished to ask Dr. Lundström three questions with regard to the terms he had used in his paper. She took it that by the title of the paper, " Bimaxillary Crowding," he meant what was obviously shown in his cases, i.e. a general

irregularity of the teeth in both jaws, the maxilla and the mandible. With regard to the " normal apical base " and " normal skeletal development," she thought that if the members knew what was meant by those terms they would know a great deal more about the whole subject. With regard to X-rays of the bones of the wrist, a radiologist had told her that the development of the bones of the wrist was tremendously variable in normal cases and that the variation might be regarded as being as wide as three years, i.e. the development in three years might be considered normal for various numbers of individuals of the same age. She showed a slide showing a case which she thought would probably be described as bimaxillary crowding. It would be seen that the lateral incisor was actually in the palate and there was a marked degree of crowding of the lower incisors. It also brought in another point mentioned by Dr. Lundström in his paper, namely, retardation of the eruption of the teeth. The age of the child was 9 years 10 months and the first permanent molar on the right had not erupted. There was a lingual occlusion on the right side, showing the extreme narrowness of the upper arch, even compared with the lower, which was itself very narrow, and lack of development round the apices of the teeth, which she thought Dr. Lundström would describe as a subnormal apical base. It would seem that the factor mentioned by Dr. Lundström, local lack of growth due to crowding of the teeth, was present. Mechanical interference with eruption did not occur with regard to the first permanent molar in question, and she took it that the lack of development was due to a lack of backward growth on the antrum on that side. In the lower the premolars would be seen to be very low down in the mandible, considering the age of the child. Very often they erupted at 10 or 11, and she thought in the present case they had two years' growth to make up before they would erupt. An X-ray of the child's wrist showed it was well up to normal standard of development. The child was a sturdy little boy, but rather short and light for his age. His father, however, was a small man, and she did not think the child would ever grow to be very big.

Dr. George Northcroft said he wished to join with the other speakers in thanking Dr. Lundström for his excellent paper. He would begin his remarks by saying that he did not believe in Clinton Howard's theories at all. It did not seem to him that the size of the skeleton had any relation to the regularity or irregularity of the teeth. He appreciated the fact that there were small apical bases and normal apical bases, but he had never been clear in his own mind how to diagnose the difference, and he would be very grateful if Dr. Lundström would explain how he arrived at his conclusions as to when an apical base was small and when an apical base was normal. When Dr. Lundström spoke of retardation, he was not quite clear whether Dr. Lundström meant retardation of development of the bone or retarded eruption of the teeth. He did not think that the retardation of the growth of the apical base was quite the same thing as the retardation of eruption, although, of course, the alveolar bone must develop along with the eruption of the teeth.

Mr. Badcock said he wished to thank Dr. Lundström very sincerely indeed for his paper and for having carried out such a very valuable piece of research work, putting theory to the test of experiment. It seemed to him that the conclusions at which Dr. Lundström had arrived were very valuable to orthodontists as a guide in their daily work. They seemed to boil down to this, that there was no proof of a correlation between general growth and growth of the jaws, and that, as Dr. Lundström so admirably expressed it, " orthodontics

is not so much to be regarded as effecting growth as changing form." He thought if that point were borne in mind it would very greatly help orthodontists in their choice of treatment.

Dr. LUNDSTRÖM, in reply, said several speakers had begun their remarks by thanking him for his valuable paper and after that they had asked some questions which seemed to show that they had some doubts as to the value of it! With regard to the question asked by Miss Smyth and Dr. Northcroft as to how he diagnosed maxillary crowding, there were, of course, certain cases which were rather difficult, but in quite a number of cases there was no difficulty at all; it was quite certain that the patients had bimaxillary crowding. There were also other cases where there might be some malocclusion, but the ease with which they were corrected showed that the apical base was normal. His investigation had been carried out to ascertain whether there was any correlation between bimaxillary crowding and retarded growth of the skeleton, and in about 37 per cent. of the cases there seemed to be some correlation, whilst in the rest there was not. He did not think it was difficult to diagnose the abnormal apical base in a number of cases, but of course there were some cases where it was difficult to do so. In his paper he had stated as having normal apical bases, cases where there was no indication at all of any abnormal positions of the teeth. They were not the most important ones; the abnormalities were more important. With regard to the measurements, the measurements he had given in his paper had only one aim, namely, to save the trouble and expense of taking about a hundred photographs of the wrist. The figures were not quite reliable, because in some cases they did not correspond to the same ages exactly, but they indicated a growth, and it was an easy method of publishing the growth indication. With regard to retardation, the first column in the table in his paper showed the skeleton growth and the second column showed the eruption of the teeth. Miss Smyth had said that the development of the bones of the wrist varied within three years, and that was quite right. He could not help the fact that they did not vary more; he had to take them as they were! It would be very much more interesting if one could have more cases of greater variation. He agreed that it would have been very valuable to have made the investigation at an earlier age, but babies did not come to his department, and he had to take the children when they did come. He believed that if the Eastman Institute undertook such an investigation it would have quite a large amount of material, as he understood that very young children were treated there. Dr. Friel seemed to be of the opinion that the apical base could be expanded with springs, but personally he did not think that the arches could be expanded and permanent results obtained in the great majority of cases. In some cases it could be done, but it seemed to him that, if growth of the jaws was a result of natural action, it was rather preposterous to think that the same effect could be obtained with springs and screws and things of that kind. He would be very glad if the apical base could be expanded by such methods. In his experience, many cases that had been treated early and apparently with very good results had relapsed afterwards, and it would have been better to wait until a more definite idea could be obtained of what the apical base would be. In his opinion, radical extraction was necessary in quite a number of very difficult cases. When he had had an opportunity of reading the remarks of the various speakers in the discussion he would try to give a more detailed reply.

The PRESIDENT, in the name of the Society, thanked Dr. Lundström for his very valuable paper, and Dr. Friel and Mr. Chapman for initiating an interesting discussion.

"SIMPLE POINTS IN TECHNIQUE."*

By R. CUTLER, M.R.C.S., L.R.C.P., L.D.S.

MR. CUTLER dealt with modifications in impression technique to meet the requirements of appliance making, and showed his method of model trimming, based upon an orientation to the mid-palate line. He showed the value of the Badcock appliance, when used with an active labial assembly, to bring about spontaneous alignment of irregular incisors in cases associated with crowding, and then detailed the methods employed to aid the retention of removable appliances, as it is on this factor that their efficiency so largely depends.

He stressed the value of removable appliances in skeleton form, utilising Markham or Crozat type attachments, most particularly when active treatment had to be maintained while the dentition is changing. A patient was shown wearing an appliance of this description to illustrate the foregoing points.

INDIRECT METHOD OF MAKING BANDS.*

By H. C. HIGHTON, L.D.S.Eng.

THE demonstration showed the indirect method of making anchor bands for orthodontic appliances, the principle of which is exactly the same as that used in the making of indirect gold inlays. It is particularly applicable in the case of young and nervous patients.

The first appointment occupies only about three-quarters of an hour to make four copper band impressions of anchor teeth, and two compound impressions of the entire arches. The case now goes to the laboratory, the anchor bands and arches are made, and are ready for insertion at the next appointment.

THE MAKING OF DIAGRAMS OF MODELS WITH A "CAMERA LUCIDA."*

By J. B. PARFITT, M.R.C.S., L.R.C.P., L.D.S.

THREE types of instrument were shown. One produced diagrams exactly "life" size, the other two made enlargements double natural size. Uses of the diagrams are, amongst others :—

(1) They lend themselves to use with a symmetroscope for diagnostic purposes.

(2) Diagrams of the same case at different times can be made on transparent paper and superimposed so as to show the changes that have taken place.

* Demonstration Meeting.

THE DEVELOPMENT OF THE MANDIBLE AND THE ERUPTION OF THE TEETH.*

By S. Wilson Charles, L.D.S.Eng.

The general principles of mandibular growth and the development and eruption of the second and third molars, described in a paper read before the B.S.S.O. in November, 1934 (published in the Dental Record, June, 1935), were demonstrated by means of microphotographs and dissections. The general principles of development and eruption of the successional teeth were also demonstrated.

It was shown that the tooth germ of a successional tooth is developed on the lingual side of the tooth germ of its predecessor and at first lies in soft tissue. It gradually becomes more deeply embedded, not by a process of invagination, but because of the upward growth of the alveolar borders and consequent eruption of the milk tooth, always, however, retaining a connecting link with the periosteum. As the tooth germ in its sac develops, it comes to lie more deeply under the milk predecessor, and a bony crypt is gradually built round it, which bony crypt communicates with the alveolar border by means of a canal in which lies the elongated connecting link mentioned above. This link is the "gubernaculum" of older anatomists, but it is not an inert fibrous cord playing a very problematic part in eruption ; it is living, fibrous tissues with an extremely good blood supply, which is at first the sole blood supply of the developing tooth. The tooth sac has the appearance of a flask with a long neck, which neck is intimately connected with the fibrous covering of the jaw. From this suspended sac the tooth germ itself in its separate sac can be shelled out, and while at first it gets its blood supply from the alveolar vessels through the gubernaculum and later, possibly, from the vessels of the bone itself, at a later date when the roots begin to develop they pick up their blood supply from branches given off by the inferior dental artery.

When the crown is developed and commences to move upward in relation to the alveolar border, the small bony canal is enlarged by the growth in diameter of the gubernaculum which at the same time appears to shorten in length (this shortening is chiefly due to the growth of the inner tooth sac and is probably initiated by changes in the pressure of the contained fluid contents of the tooth sacs). The process continues until the bony canal is enlarged sufficiently to allow the passage of the crown, and the gubernaculum gradually shortens and disappears leaving the tooth in its separate sac suspended in a sling of vascular fibrous tissue which is connected with the periosteum of the mandible. At this stage the eruption of the tooth is assisted by the upward and outward growth of the alveolar borders which are, of course, covered by the periosteum to which the sling of fibrous tissue containing the tooth is attached. This process is similar to the process of eruption of the milk tooth.

Except in so far as eruption is assisted by this upward and outward growth of the alveolar borders, it does not appear to be directly influenced or caused by bone growth ; any observed bone growth being secondary to the movement caused by the changes which are brought about in the connection of the tooth sac to the periosteum of the mandibular border.

* Demonstration Meeting.

REGULATING DEVICE.

By L. Russell Marsh, L.D.S.Eng.

This Casual Communication has a good deal about it that is casual and very little communication, so I will not waste too much of your time.

The Badcock screw is, as you know, a very useful appliance, and in view of its many advantages as a simple method of obtaining general expansion, it is worthy of some careful and critical consideration. It has a few disadvantages in common with other removable appliances. Firstly we have to depend upon the patient to wear it. Secondly we have to depend upon the patient or parent to use the key.

But it has one tendency which must be considered a fault. It does not expand the canines—at least not in any proportion to the premolar region. I expect that you are all familiar with the "removable-appliance-expanded" mouth in which the expansion is obvious in the premolar region but not across the canines. Owing to the fact that in cases of crowding the upper permanent canines often erupt externally to the arch, this is not so frequently noticeable in the upper as in the lower arch of teeth. The cause is, of course, the shape of the teeth. The canine teeth present an inclined and the premolars a vertical surface to the plate. The fact that the canine teeth are not usually at the age of treatment completely erupted, serves to aggravate this circumstance.

One obvious method of overcoming this difficulty is to fix a band to the canine tooth of such a shape as, like the premolars, to present a vertical surface to the fitting edge of the Badcock plate. The following diagrams will show a modification of such a band.

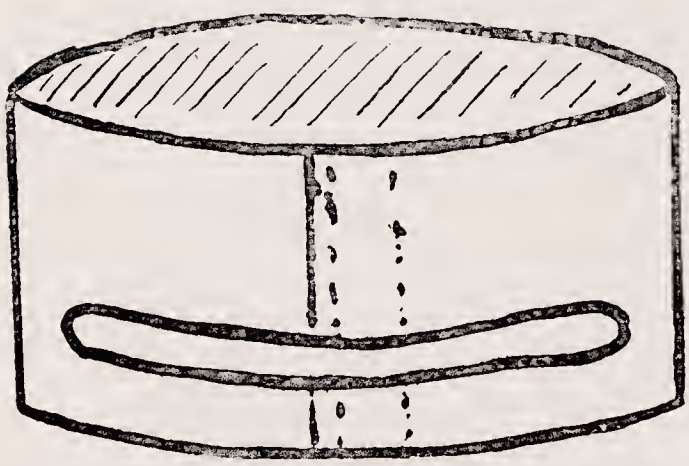


Fig. 1. Stainless steel band with horizontal wire welded on lingual surface.

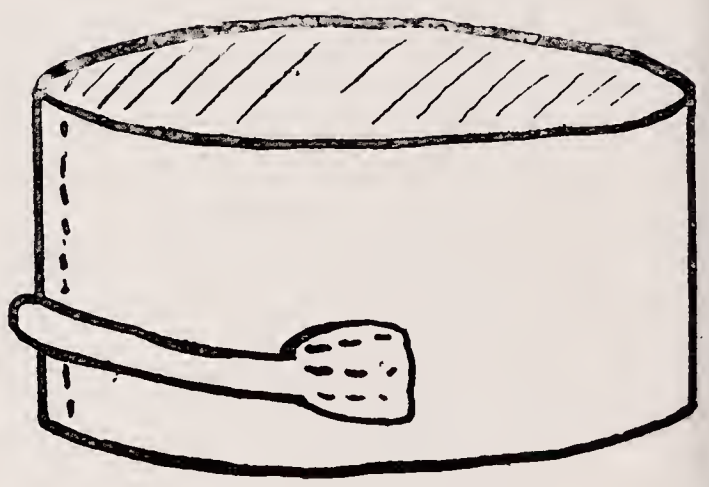


Fig. 2. Approximal view.

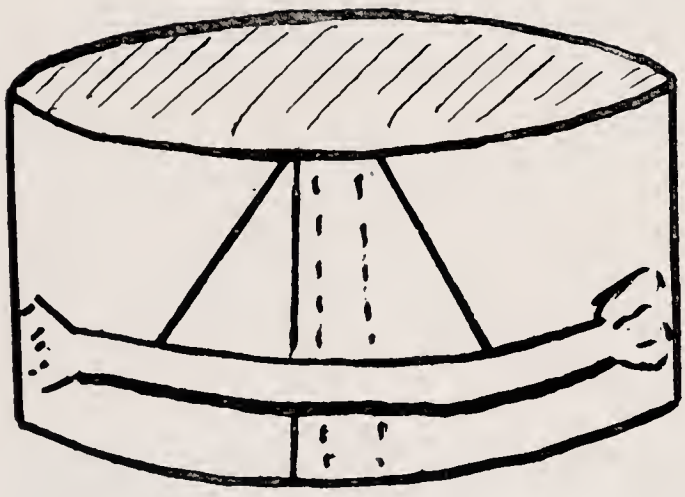


Fig. 3. Showing oblique cuts on lingual surface.

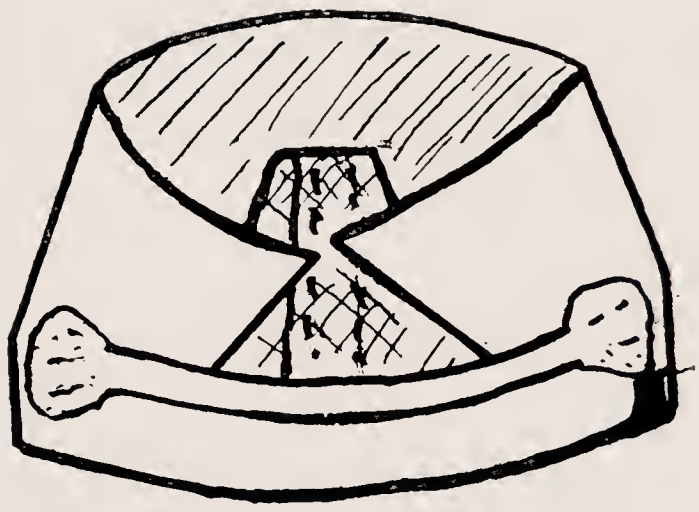


Fig. 4. Folding to fit oblique surface on canine tooth.

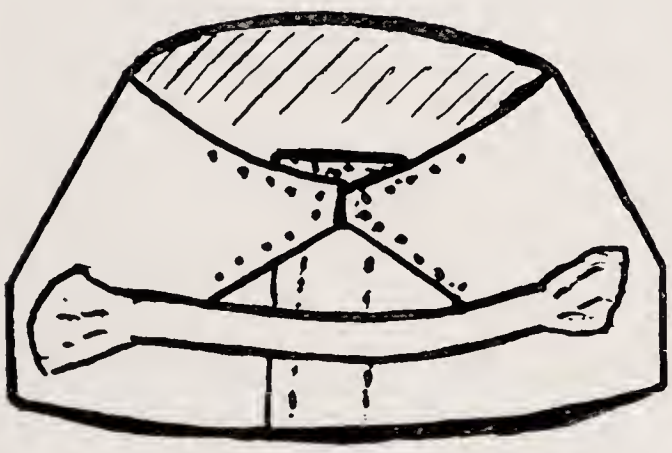


Fig. 5. Folds welded.

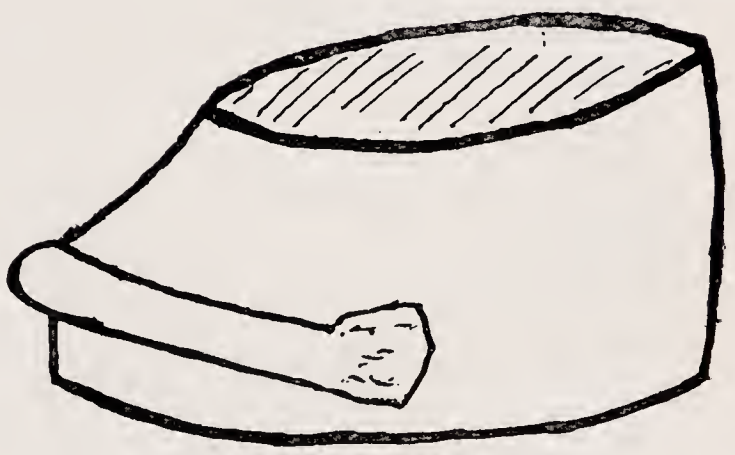


Fig. 6. Completed band (approximal) view.

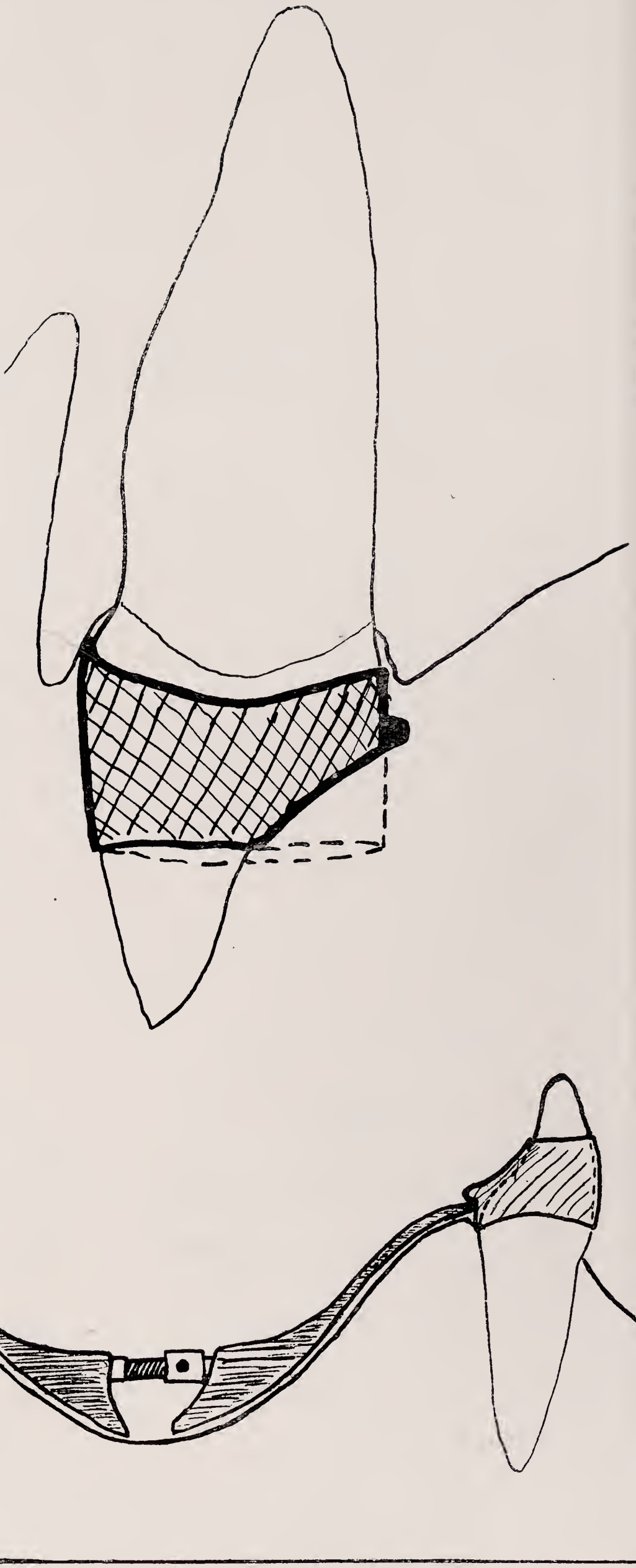


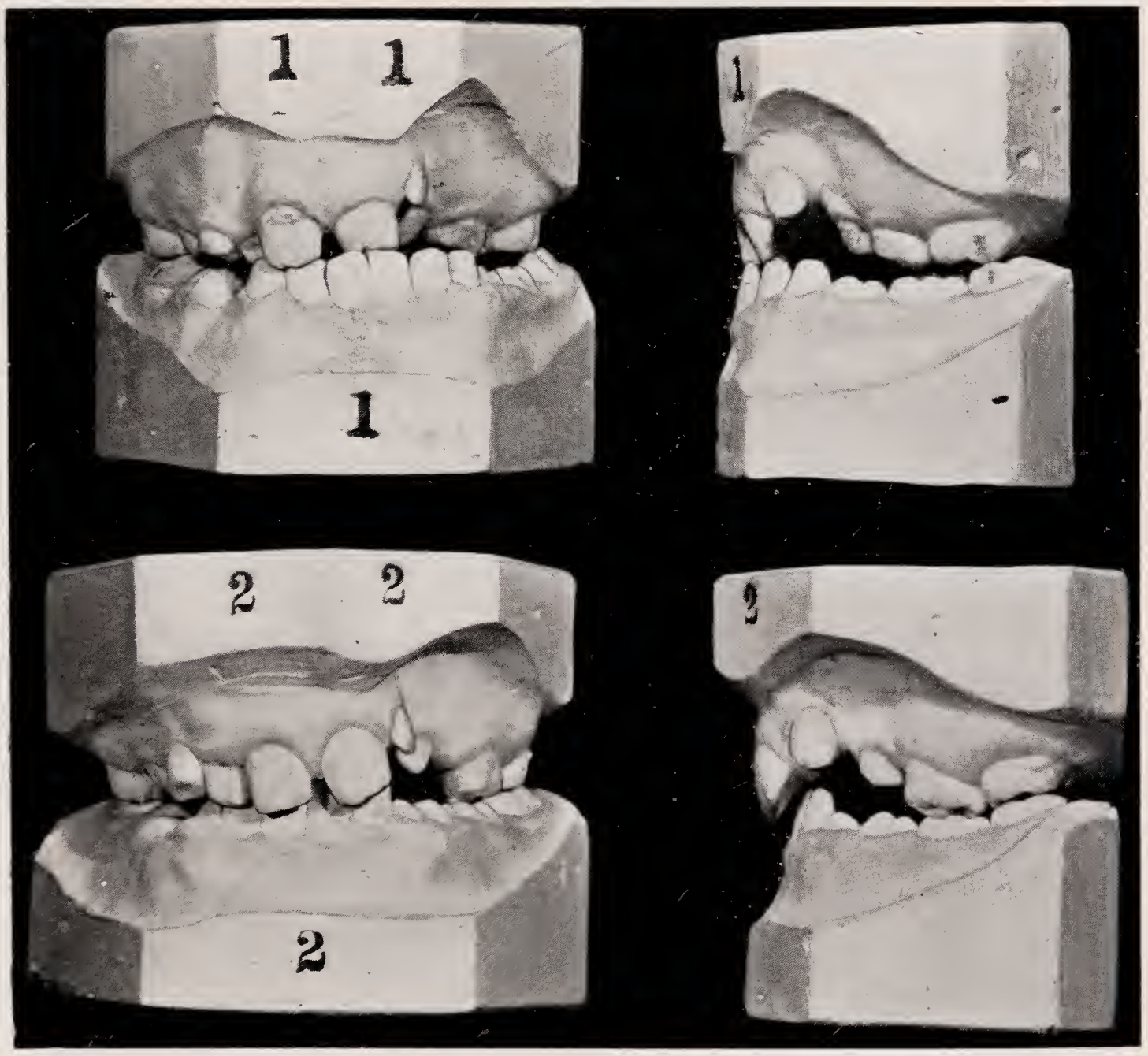
Fig. 7. Section showing band in position on canine tooth with projection to engage Badcock plate.

Fig. 8. Section showing bands and Badcock plate in position.

THE ORTHODONTIC TREATMENT OF THREE CASES OF CLEFT PALATE.*

By Lilah Clinch, L.D.S.I.

I have an apology to make concerning these three cases which I am showing this evening, as the treatment is not finished in any of them. But I know that it is a general impression that malocclusion caused by cleft palate operations cannot be treated by the usual orthodontic methods, and I think these cases show that, on the contrary, considerable improvement can be made.



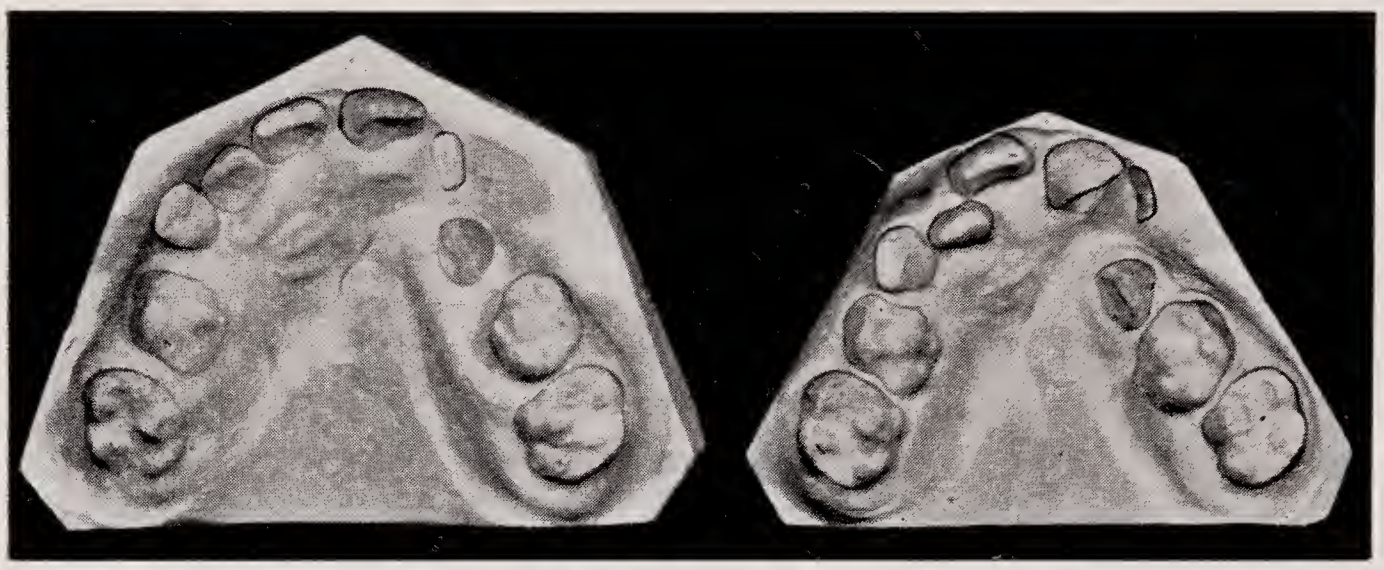
Case I. (Fig. 1.) The first case is a girl, aged 8, with hare-lip and cleft palate on the left side. X-ray photographs show that the upper left first and second premolars are absent, and, incidentally,

* *Transactions* of British Society for the Study of Orthodontics, March 4th, 1935.

the lower left second premolar is absent. There is an almost complete deficiency of bone in the region of the root of the upper left lateral incisor. The original models show the upper right lateral incisor and the upper left central incisor in lingual occlusion to the lower teeth. There is no occlusion at all between the second deciduous molars on the left side. A lingual arch carrying auxiliary springs and attached to the first permanent molars was worn for twelve months, and by this time the upper incisors were in fair alignment and the occlusion in the molar region was considerably improved.

Fig. 2 shows the palate and the appliance used.

Case II. (Fig. 3.) The second case is a boy, aged eight years and three months, with hare-lip and cleft palate on the left side. X-ray photographs show that the upper left lateral incisor and canine are absent. The original models show the upper central incisors and the upper right lateral incisor in lingual occlusion to the lower teeth. The upper first permanent molars are rotated medio-lingually. An upper molar rotation appliance with a double spring on the incisors was worn for 9 months, and by that time the upper incisors had moved labially over the lower teeth, and the molar occlusion had improved.



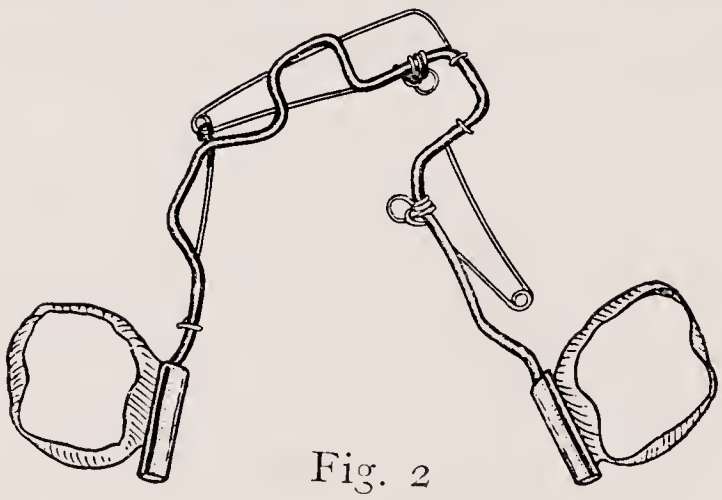
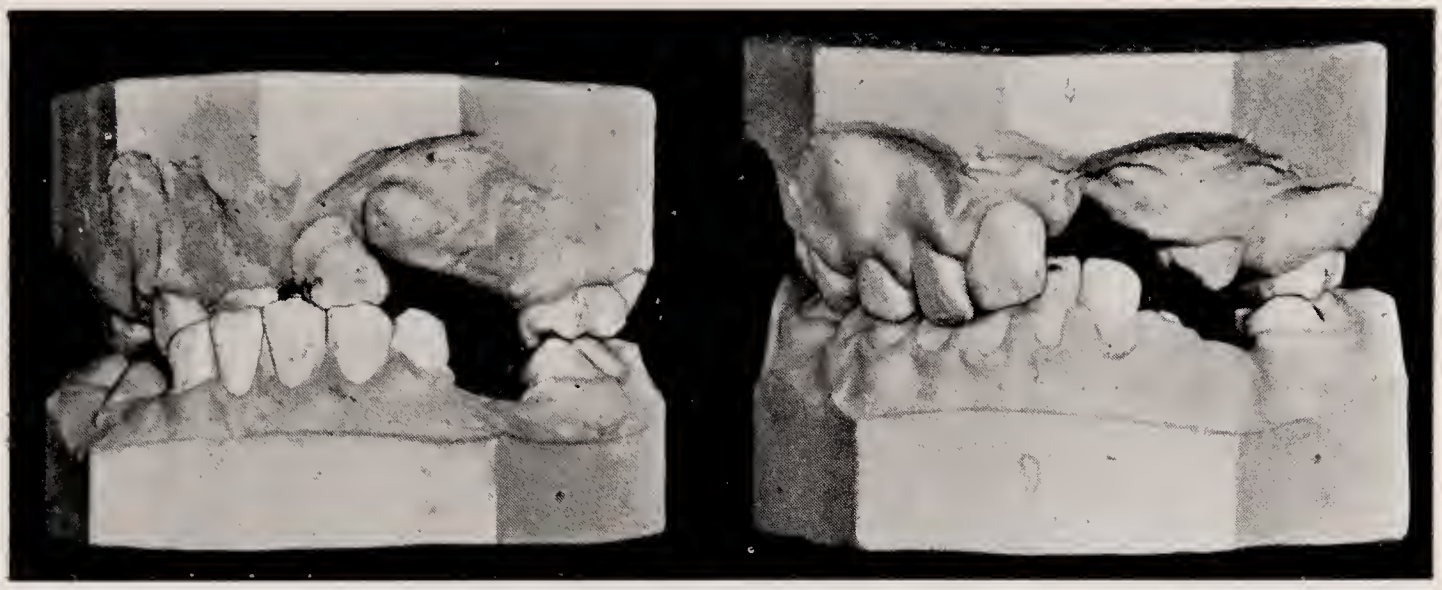


Fig. 2

Case III. (Fig. 4.) The third case is a boy, aged 9 years and 9 months, with a cleft palate but no hare-lip on the left side. X-ray photographs show that all the permanent teeth are present but the upper left second premolar is displaced. It is lying lingually between the first premolar and the first permanent molar. The upper left first premolar is in lingual occlusion to the lower teeth



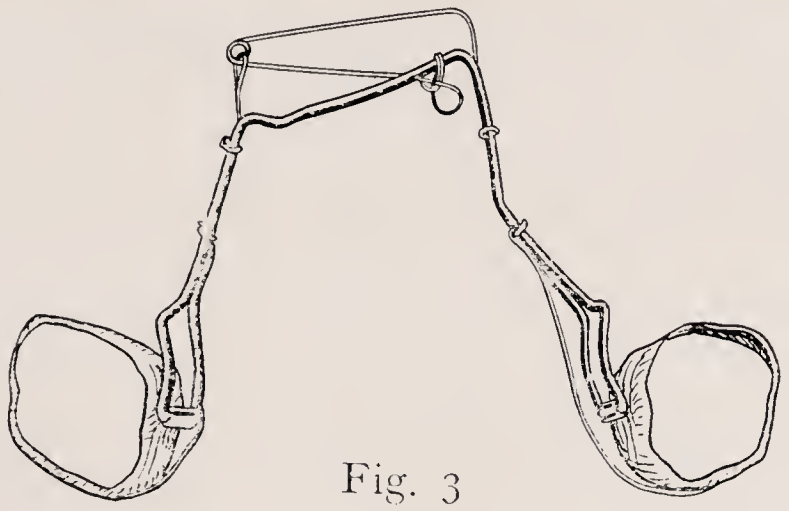


Fig. 3

and there is a considerable gap between the upper left central and lateral incisors and canine, and the corresponding lower teeth. The upper left first permanent molar is rotated medio-lingually. It was decided that the upper left second premolar should be retained in order to help in building up the arch on that side. An upper appliance with molar rotation on the left side and auxiliary springs was worn for twelve months. By this time the upper left central had moved labially over the lower teeth but had not fully erupted. The gap between the upper left lateral incisor and canine and the lower teeth had diminished considerably, and the occlusion in the premolar region had improved. The upper left second permanent molar was beginning to erupt in buccal occlusion to the corresponding lower tooth and it was extracted. Another lingual arch was worn with an additional spring to depress the upper left central incisor. After twelve months there was a slight improvement in its condition, there was no sign of looseness, and the tooth was not abnormally sensitive. The premolar occlusion had again improved, and the left upper lateral incisor and canine were touching the lingual surfaces of the lower teeth. (Fig. 5.) The advantages gained by the orthodontic treatment of these cases may be summarised as follows :—

1. Improvement in speech. In all these cases articulation has become more distinct and less of an effort. Care was taken not to expand the arches in the molar region as this would tend to bring forward the soft palate and to impair the speech.
2. Improvement in mastication.
3. The construction of a firm base for restorations. In the first

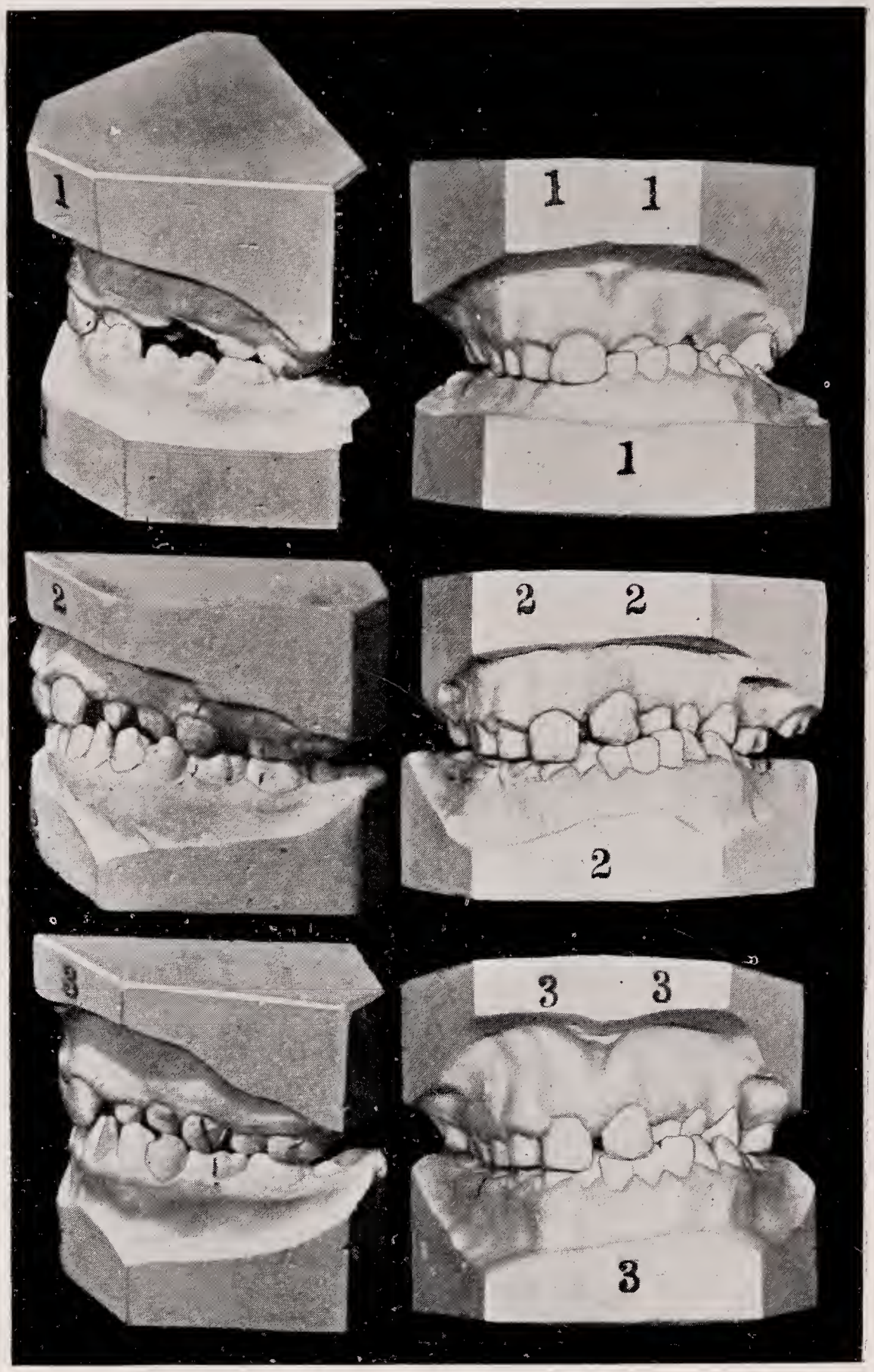


Fig. 4

two cases it will be necessary for the patients to wear dentures, and the stabilisation and design of these dentures has been simplified. If a denture is eventually necessary in the third case it will be lighter and more comfortable than would have been possible with the narrow contracted palate.

4. Improvement in appearance.

I would like to thank Mr. Apperly and Colonel Broderick for having given me permission to show these cases which I am treating at the Hospital for Sick Children, Great Ormond Street, and the Children's Hospital, Birmingham.

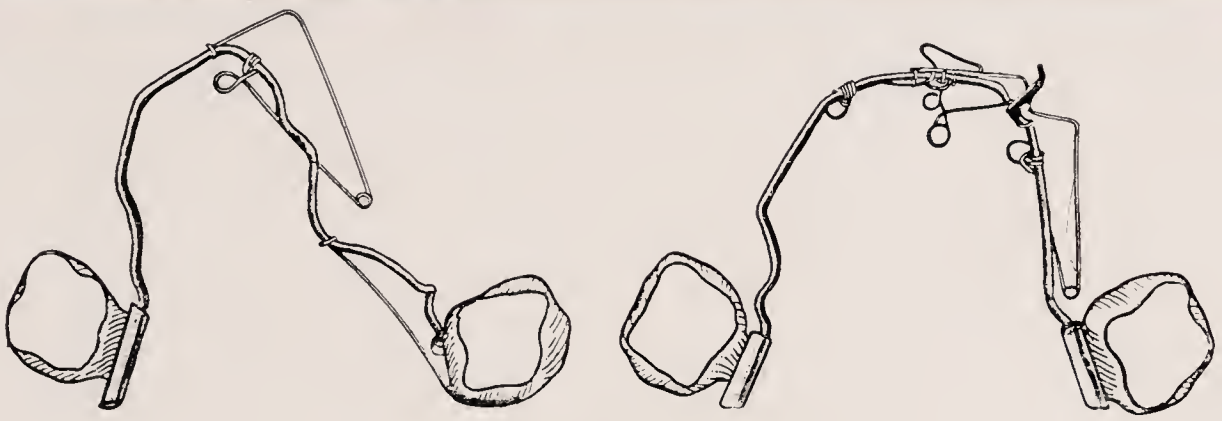


Fig. 5

Discussion.

The President said that Miss Clinch had shown three very interesting cases.

Mr. H. H. Watkins thanked Miss Clinch for her Communication and expressed his appreciation of the lucid way in which she had presented it. He especially admired the ingenious adaptation of the wonderful little finger spring to bring about the various movements.

Mr. Harold Chapman said it was perfectly obvious that Miss Clinch's treatment had benefited her patients very greatly, particularly in the last case she had described, in which it seemed likely that a permanent appliance would not be necessary. He would like to ask Miss Clinch whether she had experienced any difficulty by reason of an unusual amount of caries, which was one of the troubles he had found in cases which were complicated by cleft palate.

Miss Clinch, in reply, said she was almost certain that the cases she had described were entirely free from caries. She had not experienced any difficulty in that respect. Her only difficulty in the last case she had shown was that the patient broke his appliances about once a month on an average !

TOOTH MOVEMENTS IN THE UPPER JAW DURING THE RETRACTION OF INCISORS. AN APPARATUS FOR MEASURING AND RECORDING SUCH MOVEMENTS.*

By N. J. Ainsworth, M.R.C.S., L.R.C.P., L.D.S.

Preliminary note. It is generally recognised that the upper first permanent molars move forward if premolars are lost and that such movement is increased if they are used as anchors in the retraction of incisors, but the amount of movement has always hitherto been estimated by noting the change in molar occlusion. Now if the lower milk molars are in process of undergoing replacement the lower permanent molars are themselves moving to an extent which cannot be gauged with certainty and in such cases movement of upper molars may be masked or wrongly assessed. The demonstrator has therefore devised a method of using the palatal rugae as fixed points since it was observed that in untreated cases no change in the relative position of the rugal ridges to each other or to the upper teeth took place except when teeth were being shed.

An easily identifiable point was chosen on one of the lateral rugae as far back as possible in order to avoid possible error due to retraction of the incisors compressing the rugae behind them. (Rugae behind the first premolar region were not so affected.)

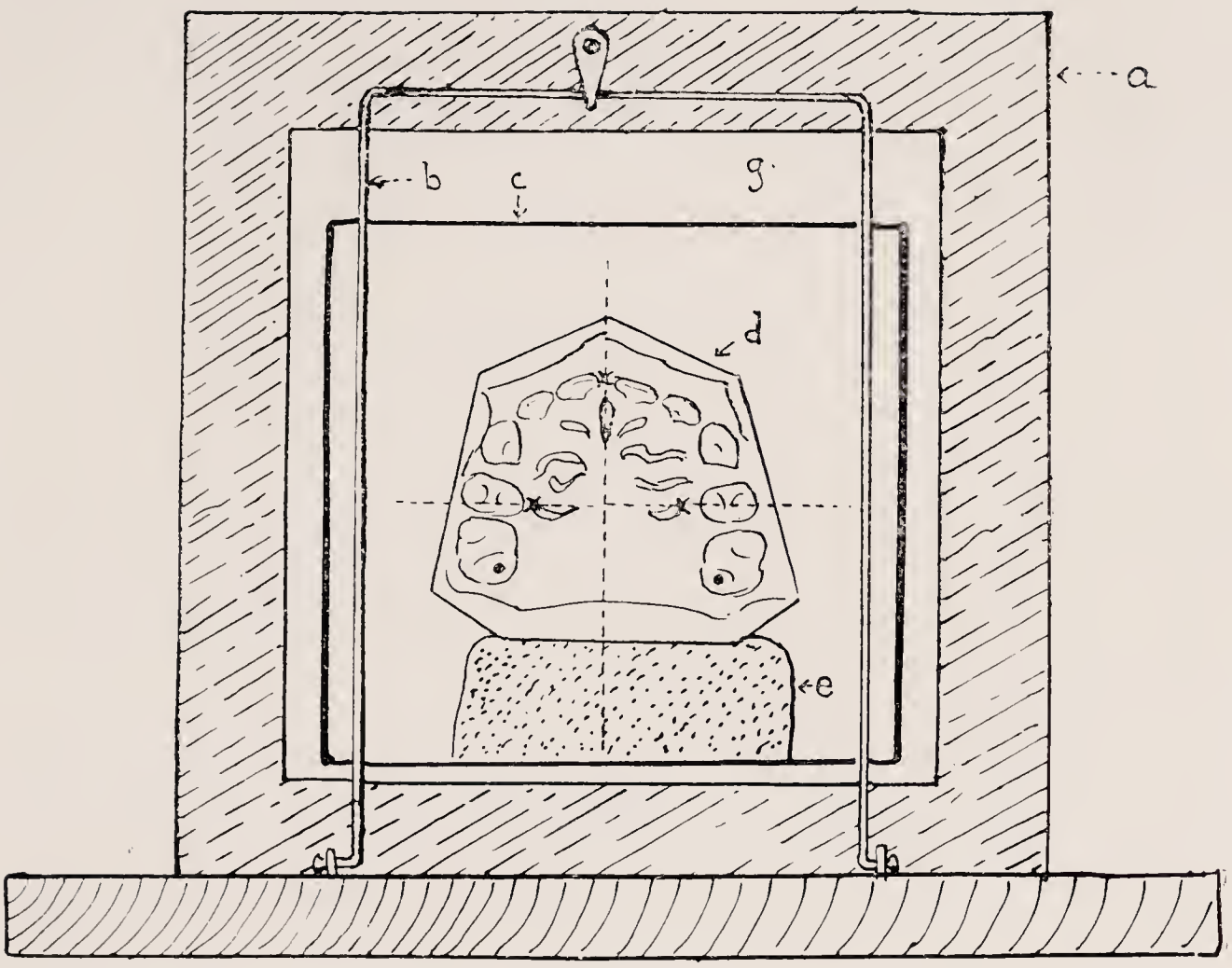
For recording and demonstrating purposes, the positions of the teeth and fixed point were charted on transparent celluloid cards, the points on the model being transferred to the card by employing the principle of a parallel beam of light.

Procedure. A sequence of two or more upper models from a given case was chosen, the median raphe being indicated by ink dots between the central incisors and towards the back of the palate. One or more fixed points among the rugae were similarly marked and also a cusp on each of the teeth whose movements were to be traced. The disto-lingual cusp of the first permanent molar was usually selected as being most pointed.

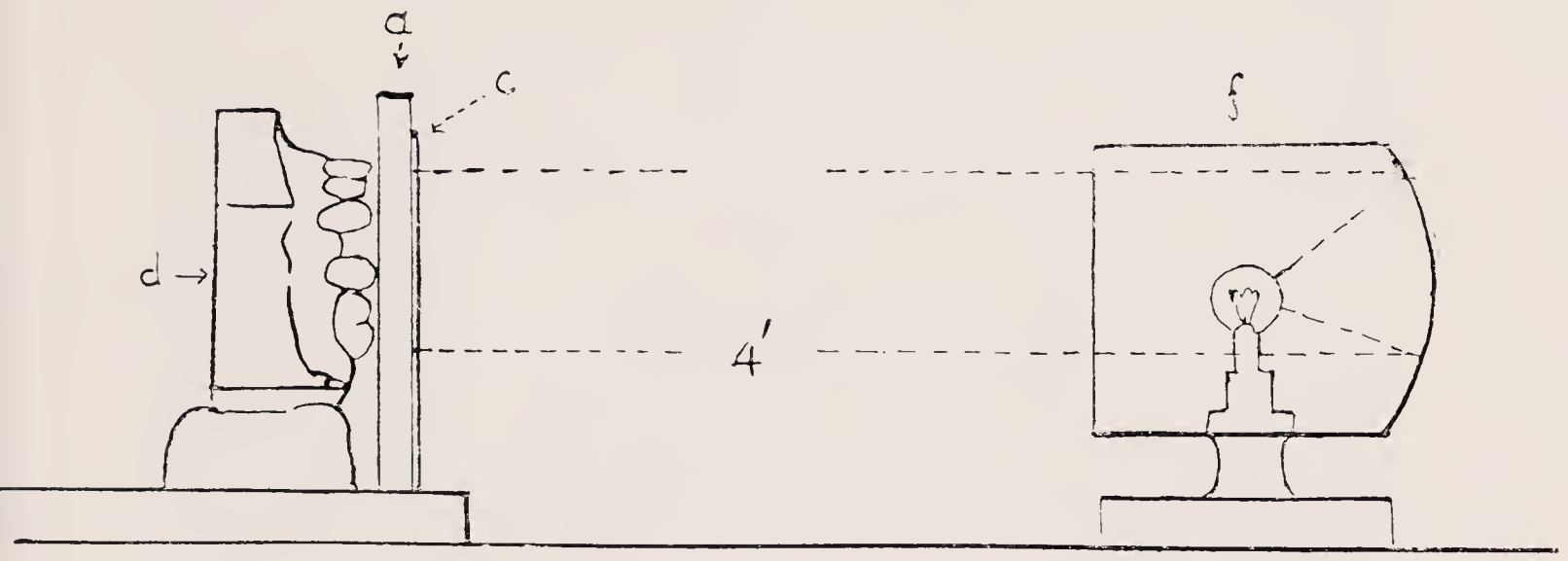
A signalling lamp with point light and parabolic reflector provided the beam of light; it was arranged a few feet away from, and pointed at, the first model which was placed on a lump of plasticine with its occlusal plane vertical. A celluloid card about three inches square, previously scratched with two lines intersecting in its centre at right angles, was fixed in a suitable upright frame between the model and the lamp—the most convenient position was found to be touching the cusps of the model as this ensured accuracy in positioning the model, but theoretically any position on the beam of light would do equally well.

The celluloid was then moved about until the shadow of one arm of the cross marked on it was superimposed on the median raphe of the model, and the shadow of the other line passed through the fixed point on the rugae. With a fine pen, dots were then made on the celluloid immediately coinciding with the rugal fixed point, the contact point of the centrals, and the marked cusps of the molars. The model was then removed and the next in the sequence put in its place and manœuvred until the median raphe and the fixed rugal point coincided with the corresponding line and point on the

* Demonstration to British Society for the Study of Orthodontics, May, 1935.



(*a*) Frame with glass window (*g*).
(*b*) Spring clip to hold celluloid against glass.
(*c*) Celluloid square marked with intersecting lines and fixed points (*x*) corresponding with certain rugae. Ready to be marked with molar cusps.
(*d*) Model arranged vertically on lump of plasticine (*e*) with ink marks on molar cusps and incisive contact point.



(*a*) Glazed frame supporting celluloid square (*c*).
(*d*) Model supported on plasticine (*e*).
(*f*) Signalling lamp throwing parallel beams.

celluloid. If the models were identical the marked cusps would also coincide, any failure to do this indicated movement of the tooth concerned. A dot of different coloured ink was made on the card to indicate the new position. The celluloid card could then be dismounted from its frame and examined or measured in detail, and if required filed for reference.

The demonstrator showed a number of such transparent cards representing as many cases, viz. :—

Two untreated cases showing no change in position of incisors and no forward movement of molars in two or more years.

Two cases treated by extraction only, showing no movement of incisors or molars until after the extraction when there was movement forward of the molars.

One case of expansion only, showing outward movement of molars.

The above were controls to test the validity of the assumption of the fixity of the rugae.

The remainder consisted of :—

Two cases treated by retraction arch and elastics, the anchorage being a *lower* lingual arch. No forward movement of upper molars occurred but considerable backward movement of incisors. There had been no extractions in these cases.

One case treated by premolar extraction followed by retraction arch, and similar lower jaw anchorage. Here there was marked forward movement of the molars.

Three cases treated by premolar extraction followed by upper retraction arch, the upper molars providing the anchorage. There were incisor cleats to prevent forward tilting of molars. Forward movement of the molars was about half the backward movement of the incisors.

Three cases treated by premolar extraction followed by removable plate with labial retraction wire. Forward molar movement was half the backward incisor movement except in one case where a year elapsed between extracting premolars and starting retraction. Here the molar movement was double that of the incisors.

Conclusions. 1. The rugae provide a convenient fixed point from which to measure movements of teeth during growth or regulation.

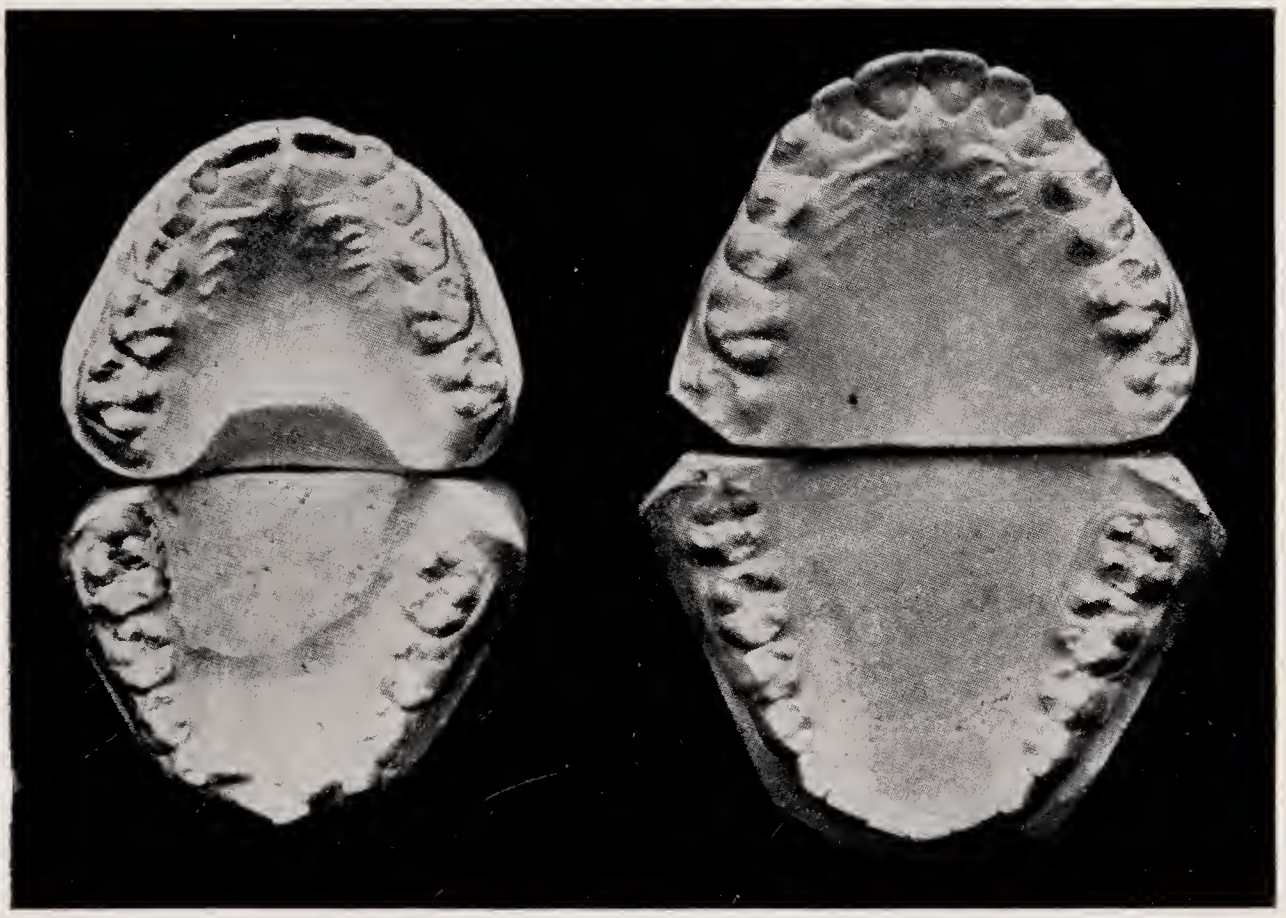
2. In all cases where premolars have been extracted the molars move forward whatever type of appliance is used to retract the incisors, the main factor governing the amount of movement being time rather than force applied, so that the policy of delaying retraction till natural backward "sorting out" of canines and incisors has occurreed is wrong unless extraction has provided much more room than required.

3. Arising out of 2, a retraction arch provided with stops to prevent it sliding on the molar tubes, and connected with lower molar bands and arch, would no doubt overcome the difficulty if it did not offer too great opposition to retraction. The molars could be allowed to drift forward again after the incisors had been retracted.

SEPARATION OF THE PERMANENT UPPER CENTRALS.*

By HAROLD CHAPMAN, L.D.S.Eng.

THE object of this paper is to arouse interest in finding a means of diagnosing if 1 | 1 will remain permanently separated. Mershon[1] in 1925 told the Society that in all cases 1 | 1 erupt separated, but in time come together (Fig. 1) ; there are a few cases in which this does not occur, but one has only to recall the very small number of adults with separated 1 | 1, with whom one is acquainted, to realise how rare such cases are. The literature does not appear to contain any information as to the diagnosis of those cases in which 1 | 1 will remain permanently separated. Recently it has been stated that the frænum is not the cause of permanent separation of 1 | 1.[2, 3]



A Fig. 1. B

FIG. 1. No. 2377. Normal occlusion (female).
A. Age 6-8, 1 | 1 separated.
B. Age 12, 1 | 1 in contact, the same case, no treatment.

* Read before the British Society for the Study of Orthodontics, Dec., 1935.

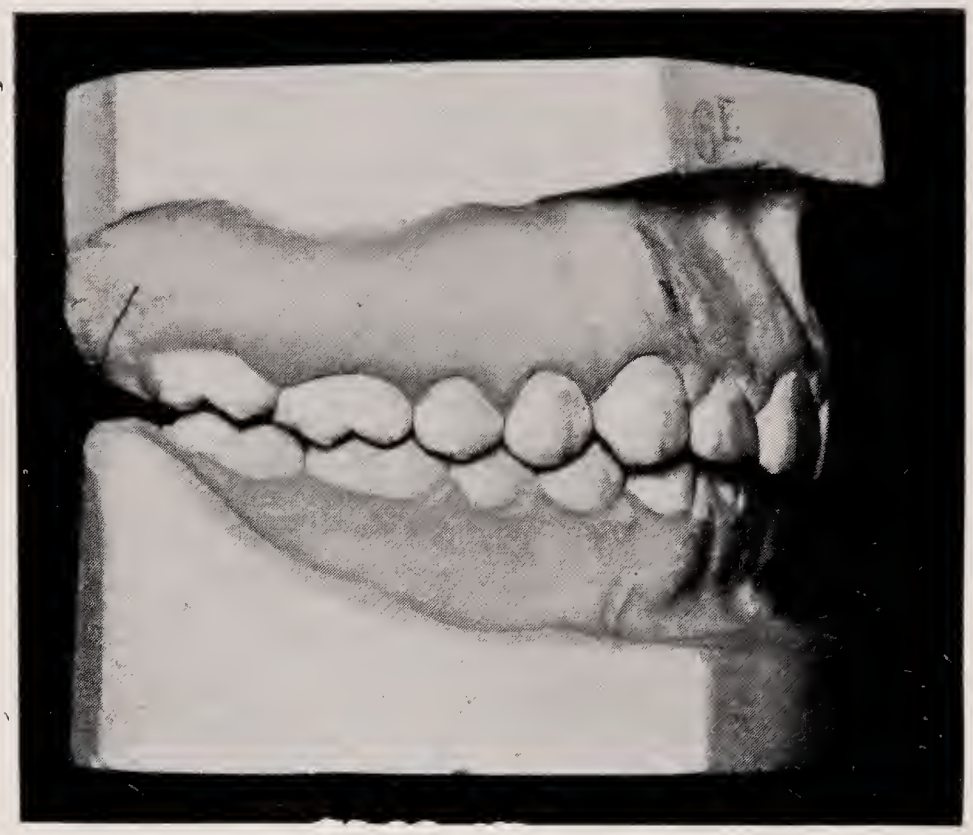


Fig. 2. (I)

Fig. 2. (II).

FIG. 2. I. No. 6. Normal frænum in an adult, age 20-1.
II. No. 1348. Normal frænum in a child, age 6-9.

There have been fewer operations or removal of the frænum since Mershon pointed out that when 1 | 1 erupt they are separated. The removal of a wedge of bone from between 1 | 1 as far as their apices, and bringing the teeth together, has been advocated as treatment for the condition[2]: there was no hint as to diagnosis. It seems that, before any operation is performed, one should know that the condition is not an abnormal one and likely to correct itself. Tait[3] has written at length on the subject, but no reference to diagnosis with a view to deciding if the 1 | 1 space will close or not was found in his paper, from which the following extracts are taken :

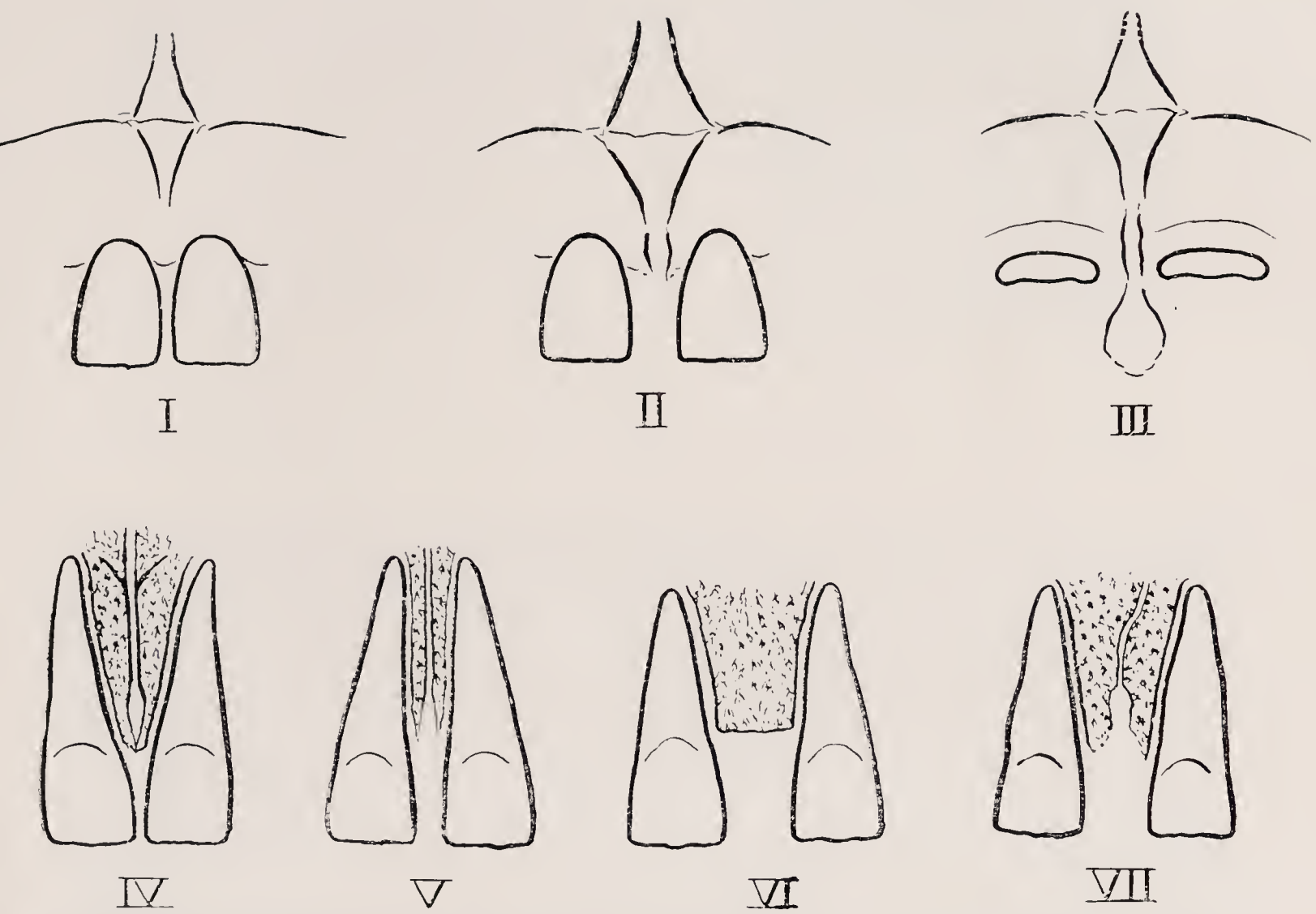


FIG. 3. Diagrammatic representation of frænum and bone between $\underline{1 \mid 1}$. I—V, normal; VI—VII, permanent separation. I, II and III represent the upper lip everted; the transverse line represents the fold of the labial sulcus.

I. Frænum in an adult.
II. Frænum in a child aged 7 years, showing cord passing to the interproximal space $\underline{1 \mid 1}$.
III. Same as II; also cord passing to the incisive papilla, $\underline{1 \mid 1}$ in cross section.
IV. Adult, age 44 years, M. (same as Fig. 5).
V. Child, age 9-7, F. (same as Fig. 6).
VI. Adult, age 50, M. Permanent separation $\underline{1 \mid 1}$ (same as Fig. 8).
VII. Adult, age 44, F. Permanent separation $\underline{1 \mid 1}$; teeth present $\frac{7654321}{7\ 54321} \mid \frac{123\ \ 7}{1234567}$ (same as Fig. 10).

"The frænum . . . cannot be regarded as having any influence on the spacing of the centrals . . ."

"Peg shaped laterals may be, and absence of $\underline{2 \mid 2}$ are a cause of separation of $\underline{1 \mid 1}$."*

"The condition recurs in families: these cases are a type—a natural variation, not an abnormality."

"In many cases of separated $\underline{1 \mid 1}$ . . . there is a block of bone between them . . ."

"The frænum is a structure sometimes associated with, but not the cause of, separated upper central incisors."

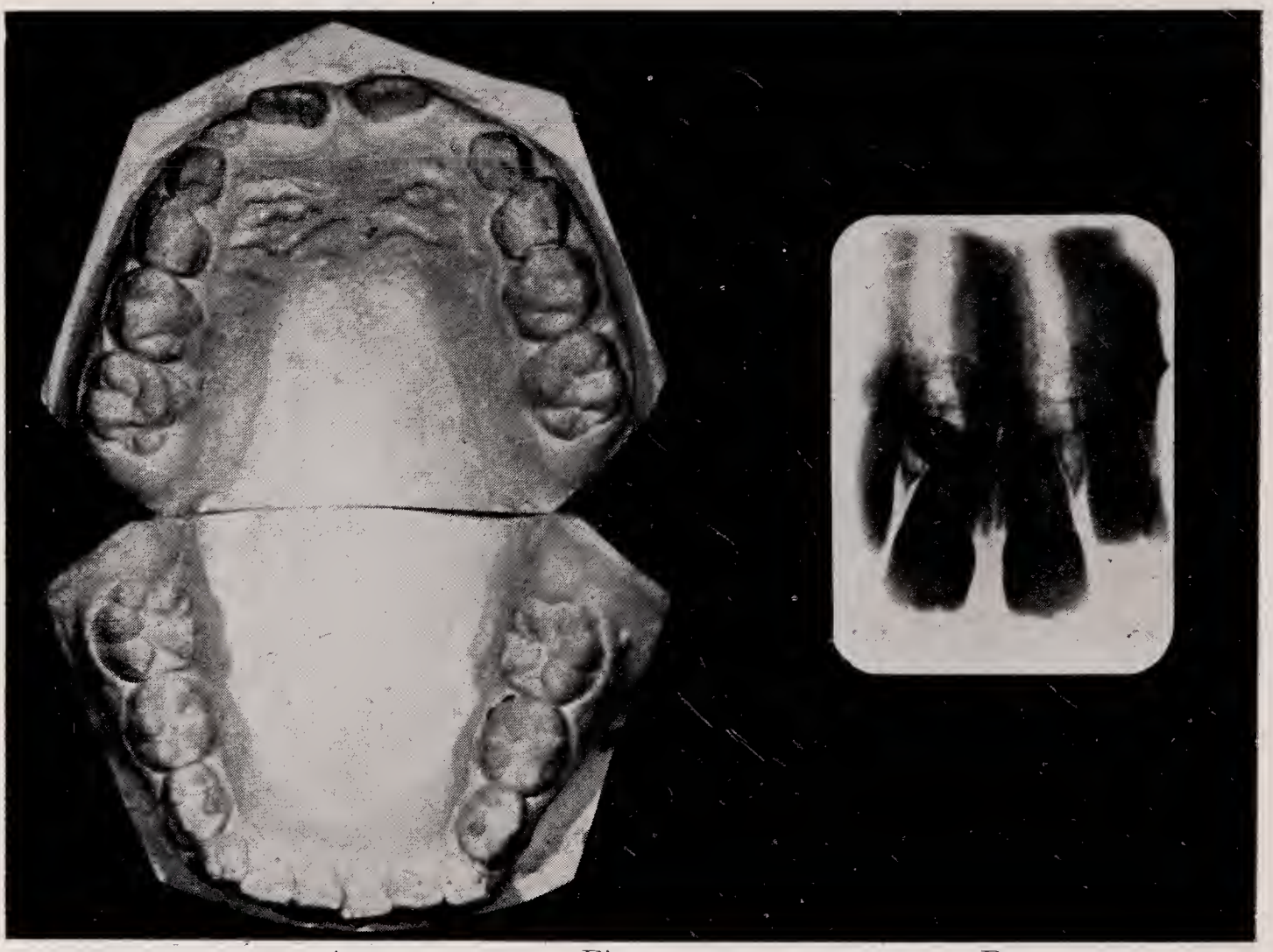
* The present writer would substitute "associated with" for the words "a cause of" separation of $\underline{1 \mid 1}$.

The differential diagnosis has not been found as a result of the present research, but a report of the investigation may be stimulating. The material collected relates to the frænum (as seen in the mouth or on the model) and the bone (as seen in X-rays) between 1 | 1 in nine cases of various kinds :—

1. Normal approximation of 1 | 1.
   a. Normal occlusion. Two cases, a child and an adult, both assumed to be normal occlusion (Figs. 4 and 5).
   b. Abnormal occlusion. Two cases of children, both Class II, Div. I (Figs. 6 and 7).
2. Permanent separation of 1 | 1, 2 | 2 present.
   Three cases (Figs. 8, 9 and 10).
3. Permanent separation of 1 | 1 probable ; 2 | 2 congenitally absent.
   Three cases ; two recorded here (Figs. 11 and 12). In Fig. 12, 1 | 1 are wider apart than a | a were.
   In two cases (Nos. 1356 and 1551—not shown—abnormal occlusion, but assumed normal as regards frænum and central separation) in which a | a are unusually wide apart, 1 | 1 are less wide apart shortly after eruption.

There is no example of the condition in the same person as child and adult.

Cases of separation of 1 | 1 associated with a supernumerary tooth between them are not considered in this paper.



A Fig. 4. B

FIG. 4. No. L.H.560. Age 9-3. Female.
A. The frænum is joined to the papilla by the cord; slight alveolar concavity between 1 | 1 labially. Separation 1 | 1 is 3 mm.
B. The alveolar crest terminates in two blunt points separated by the open suture which extends as far as the future apices of 1 | 1. S | in relation to 21 |

Fig. 5.

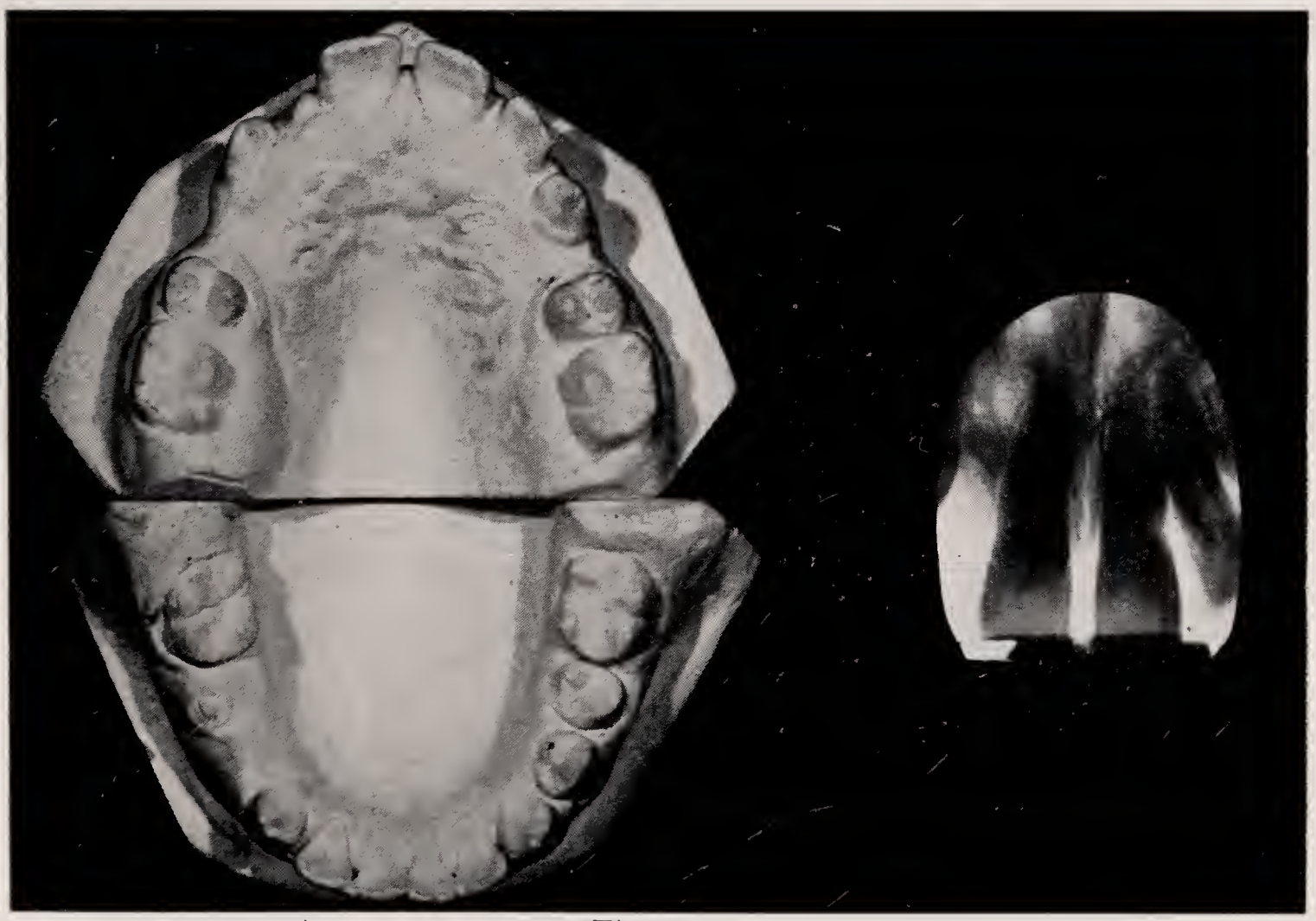
FIG. 5. No. X. Control. Age 44. Male. Normal contact 1 | 1. Alveolar crest formed by one blunt point, suture appears closed gingivally, the appearance is consistent with the approximation of the two blunt points in Fig. 4. ? if suture open apically.

FIG. 6. No. 2345. Age 9-7. Female.

A. The frænum or cord comes down as far as the interproximal surfaces of 1 | 1 and is then lost; connection with the papilla cannot be traced; the model is not good. Separation 1 | 1 is 2 mm.

B. Alveolar crest formed by two points, at different levels, separated by the open suture which does not appear to extend apically as far as in Fig. 4. The suture is lined with compact bone continuous with the lamina dura; there is very little intervening cancellous bone.

A Fig. 6. B



A Fig. 7. B

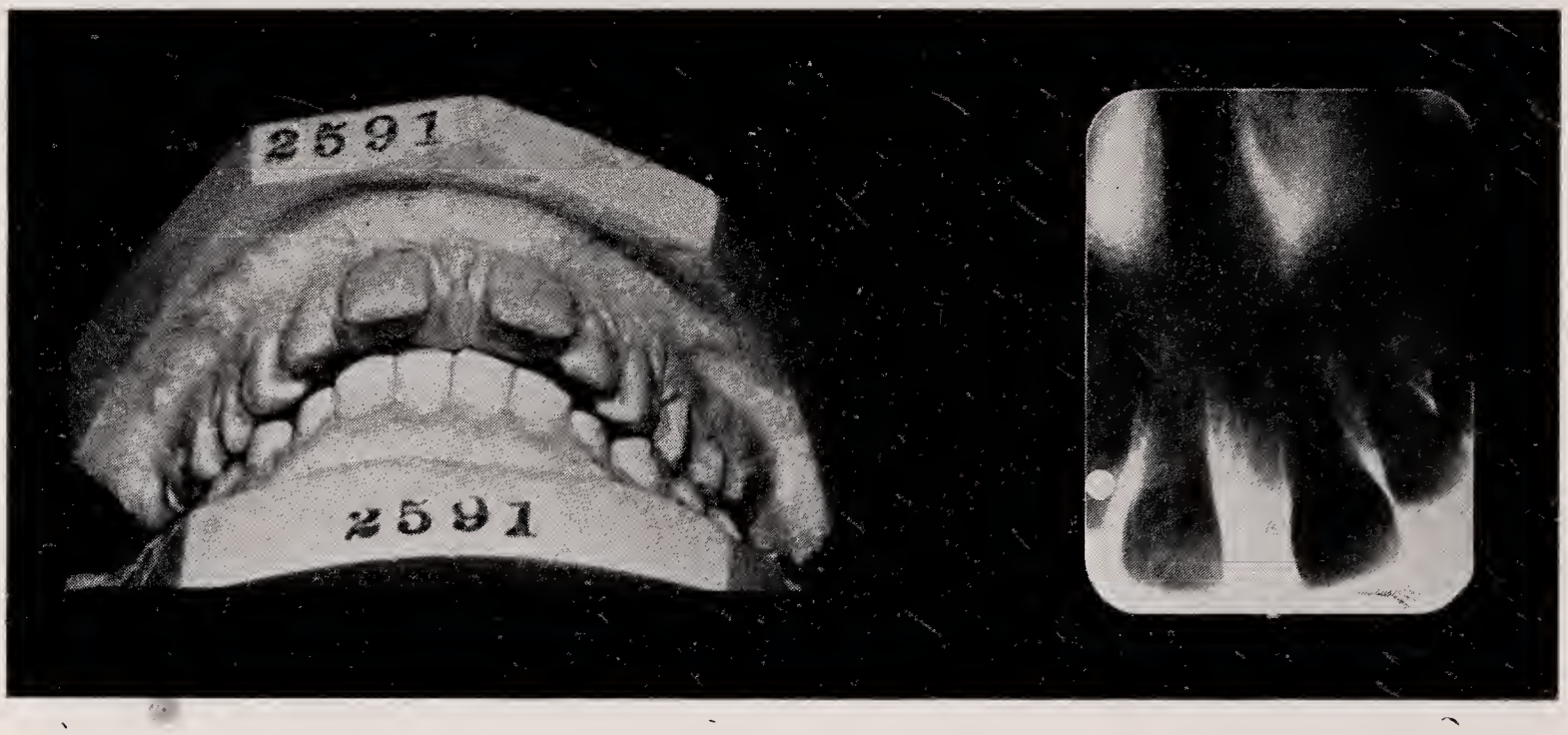
FIG. 7. No. 1847. Age 11-9. Male.

A. The frænum is assuming the adult type; connection between it and the papilla is not clear but model (not sharp) suggests it. Separation 1 | 1 is 1.5 mm.

B. The crest is formed by two blunt points separated by the suture. Similar to Fig. 6 but more cancellous bone; compact bone not so well defined. 21 | had been knocked out and reimplanted; 2 | has since been lost.

FIG. 8. Age 50. Male.
Alveolar crest is square-ended in a straight continuous line covered by compact bone continuous with lamina dura and thinnest midway between 1 | 1; the space between 1.| 1 appears to be filled with cancellous bone; there is no evidence of the intermaxillary suture. Separation 1 | 1 is probably 3.5 mm.

Fig. 8.



A Fig. 9. B

FIG. 9. No. 2591. Age 21. Female.
A. The frænum is joined to the papilla by the cord which is very short (not more than 2 mm. long) and thin; this can be distinguished in the illustration. The frænum is wider and attached lower than in Fig. 10, as in a child about age 6. The incisive papilla is long and wide, extending nearly as far forward as the labial surfaces of 1 | 1. Separation 1 | 1 is 5 mm. There appears to be a trough on the alveolar surface, but it is almost obscured by the wide frænum.
B. The alveolar crest, apparently covered by compact bone, is square ended, presenting a wide angled "V"; the suture cannot be distinguished; the tissue between 1 | 1 appears to be calcified to varying degrees.

A Fig. 10. B

FIG. 10. No. 2514. Age 44. Female.

A. The frænum appears continuous with the incisive papilla without the narrowing which represents the cord ; the model is not clear enough to permit a more exact description ; the alveolar surface presents a trough occupied by the frænum. Separation $\underline{1 \mid 1}$ is 3.50 mm.

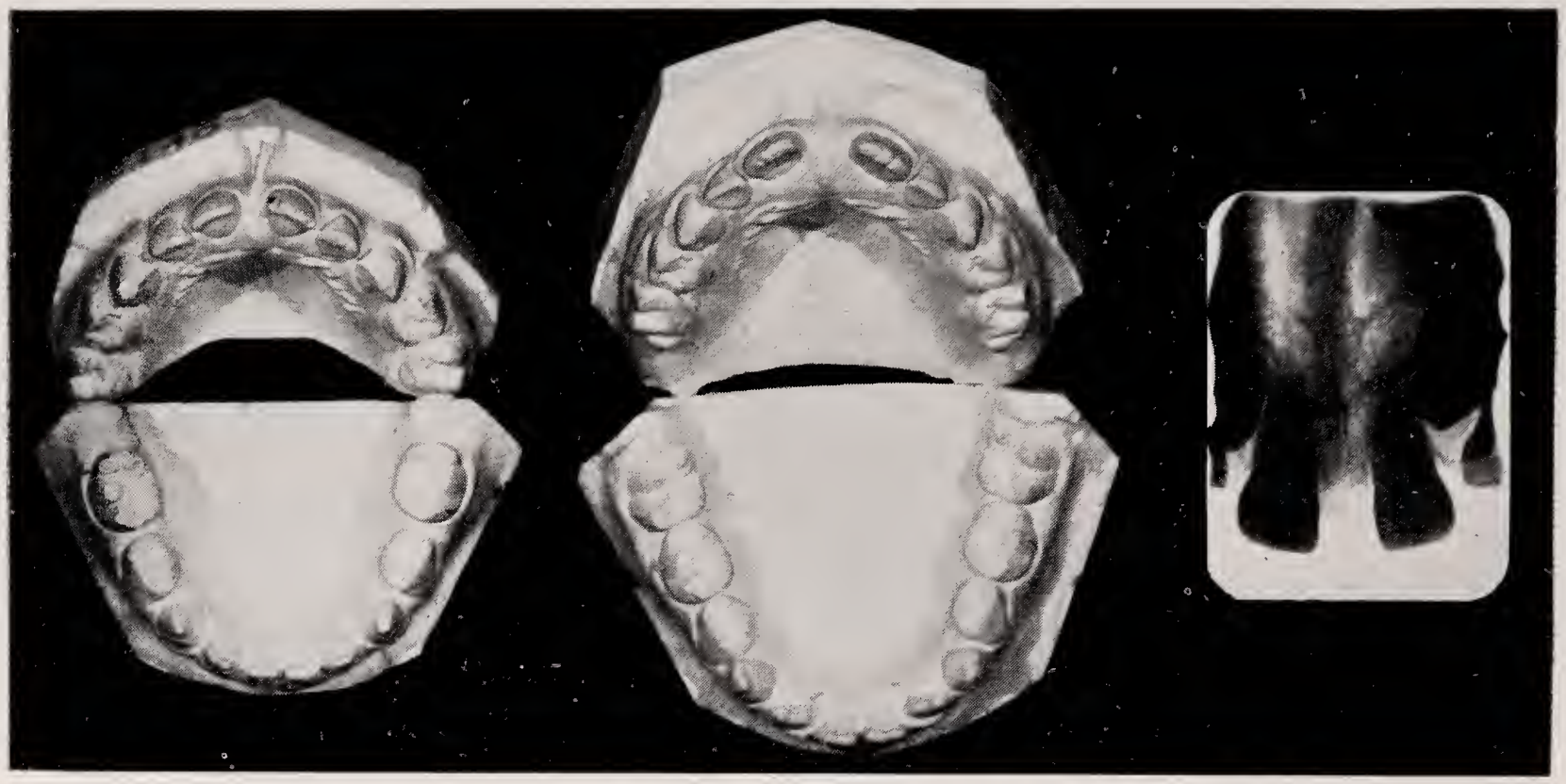
B. V-shaped cleft in the alveolar crest ; this cleft seems to continue indistinctly and sinuously, like a channel in the bone, towards the apices of $\underline{1 \mid 1}$ and is suggestive of the suture.

A Fig. 11. B

FIG. 11. No. L.H.561. Age 9-3. Female. $\underline{2 \mid 2}$ absent.

A. The incisive papilla is long as in Fig. 9 ; at its forward extremity between $\underline{1 \mid 1}$, where it becomes the cord, it divides into two and appears in the trough as two thin raised lines where they are lost ; the model does not show the frænum, so this may be of the adult type. Separation $\underline{1 \mid 1}$ is 5 mm., the same as in Fig. 9. There is a broad trough in the alveolus.

B. The alveolar crest is square ended, but does not appear to be covered with cancellous bone ; the suture appears to be open, though this is not so well defined as in Fig. 4 ; considerable cancellous tissue between lamina dura and suture ; resembles Fig. 9 in which $\underline{2 \mid 2}$ are present.



A Fig. 12. B

FIG. 12. No. 2145. Female. 2 | 2 absent. Class III. There has been treatment between the earlier and later models.

A. Age 4-3. Very clear continuity of frænum with incisive papilla. Separation a | a is 3.25 mm.

Age 7-2. Very clear continuity of frænum with incisive papilla; at both ages frænum and papilla appear to unite without a cord intervening; the lower part of the frænum appears to lie, like a piece of string, in a concavity on the alveolus between 1 | 1. Separation 1 | 1 is 5.5 mm.

B. The alveolar crest is square ended, but it does not seem to be covered with a layer of compact bone and there is a hint of a gap, roughly V-shaped; there is separation of the suture as in Fig. 4, which it resembles except for the greater width and amount of cancellous bone between the lamina dura and suture.

The frænum in an adult. It is a thin sharp fold of mucous membrane attached continuously from the alveolar process to the lip, the attachment coming to a point at the extremities, but broader near its centre in the fold of the labial sulcus (Figs. 2 (I) and 3 (I). On the alveolus it is attached 3 mm. above the gingiva: below the attachment the alveolus appears continuous; or there may be a slight vertical line (scarcely visible), a deeper coloration and a suspicion of roughness of the mucous membrane over an area of 2 or 3 square millimetres.

The frænum in a child. It is coarser and wider up to six years and older in some cases than in an adult, whether a | a or 1 | 1 are present (Figs. 2 (II), 3 (II and III) and 12) (normally these teeth are spaced at the relevant ages) and extends almost to the interdental papilla, which is not a definite structure as in an adult on account of the spacing of 1 | 1: joining it to the incisive papilla is a *cord*; the cord is usually a less coarse structure than the part

of the frænum with which it unites ; the cord may be so small as to be hardly distinguishable, yet it is quite definite on several of the models ; in some cases it is hardly more than a piece of sewing thread but may widen out as it passes upwards to be lost in the frænum. Frænum and cord appear to be in a *trough,* or vertical concavity in the centre line of the alveolus (Fig. 4) : it may be that this concavity corresponds with the open maxillary suture. The evidence seems to suggest that usually the frænum gradually diminishes in size with age and that the cord disappears, its disappearance being complete when the central incisors are in contact, thus severing continuity (as there appeared to be) between the frænum and the incisive papilla.

Appearance of bone between 1 | 1, normal approximation. In an adult (Fig. 5) there seems to be a more or less calcified union* of the two halves of the maxilla at the alveolar crest, which forms a single point, but non union, or less complete union, in the apical region : it is said that the right and left maxillæ can always be disarticulated ; it would be interesting to know if this is so in the case shown in Fig. 8.

In a child (Figs. 4, 6, 7) there appears to be a gap between the two halves of the maxilla as far as the apices, though its length seems variable ; the alveolar crest comes to a point on each side of the gap : from each point two layers of compact bone pass upwards, one the lamina dura and the other the internal surface of the maxilla—the separation of these two layers may be extremely slight (Fig. 6).

Appearance of bone when 1 | 1 are permanently separated, 2 | 2 present. There may be a solid block of cancellous bone with a compact layer over the alveolar crest (Figs. 8 and 9) : or there may be a V-shaped gap in the crest which does not appear to be covered with compact bone ; this gap appears to be continued apically in one case (Fig. 10) : the alveolar crest in Fig. 9 shows a very wide angled " V."

Appearance of bone when 1 | 1 are likely to be permanently separated, 2 | 2 absent. Described in the legends (Figs. 11 and 12).

The writer is indebted to Mr. Fawn for the case shown in Fig. 8, and to Mr. Pringle for the case shown in Fig. 10.

* Professor William Wright says it is a suture which unites, more or less, at a variable age.

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[2] Gillies, Sir Harold. " Prosthetic Appliances as an Aid to Surgery in Facial Restorations." *British Dental Journal,* October 2, 1935, Vol. LIX, No. 7, p. 361.

[3] Tait, Cecil H. " The Median Frænum of the Upper Lip and its Influence on the Spacing of the Upper Central Incisor Teeth." *New Zealand Dental Journal,* 1929-30, Vol. XXV.

Discussion.

The President said the Society was always indebted to Mr. Chapman when he brought forward a Communication.

Mr. R. O. Barber said Mr. Chapman had brought forward a very

interesting Communication, but he felt that Mr. Chapman had missed out some essential factors. For instance, many of the cases in question were of a recessive type, and when one inquired into the family history and asked if there had ever been any spacing in any of the ancestors, one was often met with the answer " No," and then the relation one was questioning suddenly remembered that an aunt or a great aunt of the child had such a spacing. He thought that in such cases the space would not close up, because it seemed to be a spacing of one of the recessive types. There was another point which Mr. Chapman had missed out. The premaxilla in its normal course developed from four centres, and those should be united at birth or within two or three months after birth. In Fig. 5 on the blackboard Mr. Chapman had drawn a line running up on a suture which at that age should have been closed. In radiographic evidence one saw that the lamina dura was continuous along the side of that suture ; that meant that the suture would never close and that the teeth must of necessity remain apart. With regard to the frænum, it always maintained its connection with the incisive papilla throughout life. That was borne out by the fact that adult patients about the age of 40 who presented themselves purely for æsthetic reasons, said that their teeth were coming forward ; the space opened up and the frænum, which before, as far as they knew, was non-existent, suddenly appeared. The reason the frænum appeared was that there was a chance for the tissues to grow. If the teeth in question were brought together in a young child the frænum atrophied, but in later life it nearly always hypertrophied.

Mr. Russell Marsh thought all the members were very grateful to Mr. Chapman for the research he had carried out on the subject dealt with in his Communication. He did not know whether he agreed with Mr. Chapman entirely. With regard to the frænum, he understood Mr. Chapman to say that it was not the cause of separation. He had in mind one case of a child of a friend of his some years ago, who had very wide separation of her central incisors and a considerable amount of crowding of the adjacent teeth. He removed the frænum, and three months later, when the child was away at school, her father rang him up in horror and said that her teeth were " crossing over." Personally, he felt convinced that, in some cases, at any rate, the frænum actually caused separation. He had known cases of adults who lost a lateral incisor or a canine tooth and who, perhaps, did not wear a denture immediately, or wore for too long a time a temporary denture which did not fit very well, and who complained that the space which had always existed between their central incisors was getting larger, and one noticed that the teeth on that side tended to drift distally. In fact, there was a very marked tendency, unless a denture was put in that fitted quite well, for that gap to become very much larger. He did not know whether that had any bearing upon the matter which Mr. Chapman was investigating.

Mr. K. E. Pringle said the only cases that he intended to speak about were those in which the jaws were in normal relationship to one another, no supernumeraries were present preventing the central incisors from coming together, and there were no missing teeth. Before there could be a standard or established case of spacing between the central incisors, he thought that all the teeth must be present in the maxilla and have erupted. He had looked for a long time, and he had never found a case with all the teeth erupted, but he thought that such cases did exist. He thought two types of cases could be distinguished, one being cases in which the space between the incisors was rectangular. He attributed that sometimes to a lack of fusion and sometimes to an extra amount of bone in that area. In the models it would be found that the two halves of the maxilla separately seemed to be quite normal ; they just seemed to be unable to get together. In the other type the space increased from the cervical margin to the tip, and in those cases he thought that the frænum was usually the cause of the

space : it guided the teeth apart as they erupted. He would like to show models of a case which had come to his notice recently. It was a child of six years old, who came to the dental department for children at Guy's Hospital. The models showed, he thought, a definite abnormal spacing between the temporary central incisors and an enlarged frænum. The child's mother said that the space had always been there ; he did not know whether one could rely on that. The X-ray photographs showed the upper permanent central incisors close together before they erupted. He wondered whether, if the frænum had not been removed, as it had been, those teeth would have come through with a space between them.

Mrs. LINDSAY said that Mr. Chapman's Communication was a very interesting one and dealt with a subject which the members might well investigate. She thought it was probable that Mr. Chapman was aware of the investigations of Mr. Cecil Tait in New Zealand. Mr. Tait had done some research work on the frænum and had come to the conclusion that it did not influence the separation of the teeth, and also that, when the teeth were separated by a wedge of bone (as in one of the cases which Mr. Chapman had shown), it was a definite type, upon which an operation would have no effect. Recently she had had the privilege of seeing the proof sheets of Sir Frank Colyer's new book, in which he referred to several cases of apes that had exactly that condition —the separation of the two centrals—so that it appeared to be a type. She had not remembered that Mr. Chapman was to bring forward the subject that evening, or she would have made a note of Sir Frank Colyer's cases. The proof sheets had been returned, but reference could be made to the book when it was published.

Mr. H. G. WATKIN said he would like to corroborate the statement made by Mr. Russell Marsh, that an abnormal frænum did not prevent the coming together of the central incisors. In one case of a girl of eight years of age, who had all her teeth present and in good condition but had separation of the central incisors and a very large frænum, he had removed the frænum, and three months after its removal the central incisors were close together. Only last week a sister of that child had had the same operation performed, and in her case also the central incisors had come together. Certainly the presence of the other teeth must bear on the pulling together of the central incisors.

Mr. H. CHAPMAN, in reply, said that Mr. Barber had made a very useful contribution to the discussion, particularly with regard to heredity. He had little more information on the subject than he had already given. He had found what appeared to be a space between the maxillæ in the region of the roots of the central incisors in all the children, and he could not help thinking that it was normal. If it was not normal, then he was very much at a loss to suggest what the normal condition was at that age. The cases he had shown on the screen had been picked out from a large collection of X-ray photographs and were the only suitable ones that he could find : the paucity was accounted for by the fact that frequently the X-rays were taken when the permanent central incisors were present, and so there did not always appear any necessity for this region to be photographed, though it was eminently desirable ; in fact, he would say it was necessary. He was very interested to hear that a frænum might grow again after the loss of teeth : he hoped Mr. Barber would show such a case in the near future. With regard to the case mentioned by Mr. Russell Marsh, he would like to know the age of the girl.

Mr. RUSSELL MARSH : She was about 8 years old.

Mr. H. CHAPMAN said he could not help thinking that the teeth might have come together in that case. The first case that he had shown with a space was a child of eight years of age, and the space closed up much later. The teeth were later still in coming together in the case of a brother or sister of that child.

THE TEACHING OF APPLIANCE DESIGN IN ORTHODONTIA.*

By H. T. A. McKeag, B.A., B.Dent.Sc.Dubl.

It has always been a weakness in orthodontics that the expert has been very imperfectly able to pass on what he has learned by experience to the novice, who accordingly has had to attain knowledge by personal experience ; and unless he has exceptional capacities for observation and deduction, that knowledge is dearly bought. There will long remain fields where this slow and unprofitable process must go on, but it has seemed to me for a good while past that, in the field of orthodontic appliances, the knowledge gained in past experience was not being made available to students to the extent that is in fact possible.

The most usual method of teaching mechanical treatment in orthodontics consists in demonstrating a variety of appliances that have been used for particular purposes. The method has considerable value, just as an acquaintance with a wide range of bridges that have been built has value to the novice in civil engineering. But I think I should not find it very difficult to arouse your sympathy for a newly-fledged orthodontist having before him a case requiring fairly elaborate treatment, and in his mind only pictures of all the mechanical devices that the fertile genius of his predecessors in orthodontics has evolved. The one thing that saves the average man in such a situation, is that the prejudices of his teachers and the limits on their time have generally reduced his range of choice of appliances to a number between two and a score. Aided by some dim preception of how mechanical things work, he makes his choice, and I fear that generally his experience as a boy with engines and " meccano " has more influence on his success than has his orthodontic teaching.

In recognition of the defects of this system of teaching, attempts have been made to lay down " principles " to which appliances must conform. I find in a recent " Textbook of Orthodontia "† a list of seven " qualifications which correct physiological principles demand of the force inherent in an orthodontic appliance." As there is no such thing as a force inherent in an appliance we must assume that they are intended to apply to the force which an appliance is made to exert. These qualifications are :—

(1) " It must be of sufficient power to be stimulating to the bone cells, which means that it shall produce an increased blood supply to the part, and thus excite and nourish a greater cellular activity."

(2) " This force should not be powerful enough, nor so sudden in its action as to be traumatic and so cause inflammatory reactions with blood stasis and cellular disintegration and death."

The phrase " suddenness of action " used here seems meaningless. Almost all sources of pressure exert their maximum force immediately on application, and the exceptions only have a delay of about ten minutes,‡ so that if suddenness is a vice all are damned.

(3) " This force must be definite in the direction of its line of activity."

* Read before the British Society for the Study of Orthodontics, Oct., 1935.

† "Text Book of Orthodontia." R.H.W. Strang. London : Henry Kimpton. 1933.

‡ See North-west University " Bulletin," May, 1935, for account of behaviour of contractile ligatures.

I can only guess at the idea this is intended to convey.

(4) " It should be so flexible as to be under the perfect control of the operator."

This has no meaning. A force is not flexible, and flexibility has nothing to do with control.

(5) " It must be of uniform intensity throughout the entire period of its activity."

After some pondering I came to the conclusion that this could be achieved by using gravity. With orthodontic appliances as we know them it is completely impossible of attainment, though I know of no reason to think it desirable.

(6) " It must be continuous in action for a long period of time, the duration of which should at least cover the interval between visits of the patients."

I find myself in complete sympathy with that. Unfortunately, views as to what should be the intervals between visits of patients differ rather widely.

(7) " There should be no backlash associated with this force, thus permitting the teeth to revert toward their original positions after having been moved correctly to a greater or less degree."

I find it impossible to get any agreement as to what " backlash " means, so that I can only leave it to my listeners to decide what value that " principle " would have for a student.

These are not, perhaps, representative principles of design, but on the whole the method has not been very useful, because the variety of cases to be covered is so great, that if a generalisation is capable of covering them all it is generally so vague that it throws no light on the individual case. Now orthodontic appliances are all individual cases. Each is a unique thing, requiring to be designed from the start for its own unique task. So that general principles are rather stars to act as ultimate guiding points than head-lamps to light the immediate path.

I have not attacked the usual methods of teaching without having, not so much a substitute as an addition, to suggest. I want to see design taught as a synthesis, not as a selection, and my purpose in this paper is to illustrate the synthetic method of approach to design in teaching.

Before I start trying to build up I want to do some more taking to pieces. An active orthodontic appliance is a machine for applying pressure to teeth in order to bring about their movement. Now if we analyse appliances as machines we find that they all consist of but two essential parts, a source of pressure (which may be multiple) and a framework for distributing the action and reaction of the pressure. But the appliance is not merely a machine, it is a machine which has to do something to teeth which are part of a living human being. So that the primary consideration in designing an appliance must be that its object is to be achieved in the way best suited to the human tissues involved. Consequently to make a good design we must know not only the nature and behaviour of sources of pressure but also the nature and behaviour of human tissues, and indeed of human beings themselves. It is obvious then that as equipment for designing appliances the student needs a considerable body of knowledge. I am not satisfied that that knowledge is set out in textbooks in the most useful way, and some that I consider essential is not given, but it is impossible for me to give my own version

FIG. 1. | c d e form a group suitable for application of a common source of pressure, the units requiring to be moved in similar, though not identical, directions.
e d c |, e d | d e and 2 1 | 1 2 are likewise possible movement groups. | 1 and 2 | have similarity of direction of movement, but may be treated as a group or given separate sources of pressure at convenience.

of the whole of it here. I shall have occasion, however, to set out certain items from it.

Assuming that the student is acquainted with this raw material, how is he to utilise it ? The starting-point of design is that certain teeth are to be moved a given amount in a given direction. What the teeth are, what the amounts, and what the directions are matters that have been determined in the course of diagnosis. The task now is to devise a machine which will translate into fact the decisions based on that diagnosis, by putting pressure on the teeth. The first step towards this is the division of the teeth to be moved into groups which shall share a common source of pressure, in order to reduce to a minimum the number of sources of pressure. The essential characteristic of a tooth group of this sort is similarity of direction of movement (Fig. 1). Equality of distance of movement, and proximity, simplify application of a common source of pressure, but are not essential. Two of a group of incisors, for example, more displaced than their fellows, may be brought under pressure initially, the remaining pair coming

under the influence of the same source of pressure as movement proceeds. Also molars on opposite sides of the arch, and even the arch as a whole, may be moved as a group.

Grouping of teeth for movement leads to the second stage, the provision of a resistance group in order to counterbalance the reactions of the pressure used for movement. Some of the knowledge which is relevant here is set out in the textbooks in a way that is apt to be misleading, so I summarise it in the form which I think is most useful :—

The fact that teeth are set in bone results in their not only being able to move in response to pressure, but also in their being able to resist pressure.

Teeth in bone of loose texture have less resistance than those in bone of close texture.

Resistance is (other things being equal) directly proportioned to root area.

Active growth acting on teeth gives those teeth added resistance against pressure in an opposite direction, and negative resistance in the direction of growth.

Muscular pressure may add to the effective resistance of teeth.

Interlock of cusps of opposing teeth adds to the resistance of the teeth concerned.

Since all pressures applied to the crowns of teeth are working on a point remote from the centre of resistance, the leverage creates a tilting effect. It is possible in certain circumstances to apply the pressure in such a way that part of it is used to oppose this tilting, so that the net pressure against which resistance is desired is reduced.

My time is inadequate to allow me to explain why I prefer this mode of statement, but I may deal with one point by way of example. The statement is commonly made that molars have greater resistance to distal than to medial movement. But it is in virtue of active growth that they commonly have that greater resistance, and absence of that active growth, as is frequently the case in the upper jaw in "Class 3" cases, will lead to grave miscalculation of resistance if the usual statement is accepted.

The ideal method of counterbalancing reactions is to enable them to cancel out. Where two units of equal resistance require to be moved in opposite directions we may, if the distances are equal, use a common source of pressure for movement, or we may use two equal sources of pressure. Even where there is disparity of resistance between units requiring opposite or nearly opposite movement, a partial cancellation is valuable in reducing the resistance required for unbalanced reactions. Where it is found on estimation of all movement groups that unbalanced reactions remain, an independent resistance group must be arranged from the teeth it is not required to move, and the estimated resistance of this group must show a substantial margin over the unbalanced reactions, since some of the factors are only roughly assessable. It is to be noted that if the pressure used is high it may exceed the resistance of both movement and resistance groups. This is one of the outstanding disadvantages of high pressures. It will sometimes be found that unbalanced reactions are so large that a resistance group of sufficient capacity to counter them cannot be found in the same arch. Where that is the case, either the

movement group must be reduced or a resistance group of greater capacity must be found in the other arch.

Now it is a useful division of appliances to say that there are those in which the necessity of moving a high-resistance group involves the use of rubber in tension in order to utilise the teeth of the other jaw as resistance, and those in which both movement and resistance groups can be in the same arch, permitting the use of other sources of pressure. Since I cannot cover the whole field, I propose here to leave the process of designing as applied to all possible cases and concentrate on designing for the second class, in which conditions permit the accommodation of the whole appliance within one jaw.

We have reached the stage where a source of pressure must be chosen. In the range of cases to be considered there will be teeth that must be moved singly and teeth that it will be convenient to move in groups, and there will be considerable diversity of direction and distance of travel. It is likely that no one form of source of pressure will best suit all cases, so it will be necessary in designing for the individual case to review the conditions of the case and the various sources of pressure available in order to select that one whose characteristics best suit those conditions. Maximum and minimum pressures are determined mainly by the number of teeth in the group, so that the variables that have to be considered are distance and relative direction of movement in the units of each group. Now to move a tooth its whole distance of travel you may use a source of pressure which will be capable of working over the whole range with the initial setting, or one capable of working over a fraction of it. It is the alternative of using a train which requires refuelling at each station, or one that can make the whole journey without a stop. If the journey is long it is obvious that there must be some serious disadvantage about the non-stop train or the non-stop source of pressure to make one use the refuelling one. So we may take it that in trying to choose for each case the most suitable source of pressure, the designer will have this ideal in view ; that it shall exert a pressure suitable in amount and direction over a range equal to the distance the tooth or teeth to which it is applied have to travel.

If the characteristics of sources of pressure were dealt with in textbooks I could cover this part of my field shortly, but it seems clear that even those who best design and operate appliances, and who do understand the behaviour of their sources of pressure, cannot give an account of that behaviour which will guide a student. So I propose to make a digression from the actual process of designing, in order to examine some sources of pressure in detail and illustrate how a student can be taught to take into account their characteristics in deciding on their fitness or unfitness for various purposes.

In Fig. 2 we have a diagram of a straight piece of metal of round section and uniform rather elastic material, fixed at one end, free elsewhere. Its dimensions are : length, 1.8 cm., thickness, .35 mm. The reasons for those particular dimensions will appear later. If you deflect that piece of metal by a pressure at right angles to its extension, you store in it the amount of pressure you use, and in trying to get back to its position of rest it will give out again that same pressure.

EARLY TREATMENT OF ORTHODONTIC CASES WITH HEAD CAP AND TRACTION.*

By Lilian Lindsay, L.D.S.Edin.

Mrs. Lindsay reminded the members of the "Roentgenological Studies of the Temporary Dentition," by Drs. Bustin and Leist, which she had described to them the previous year. The present work was a sequel to the former one—in it were discussed the various pros and cons of early orthodontic treatment which could only be answered by a consideration of such X-ray studies of the condition and position of the tooth germs underlying the deciduous teeth. Only in this way could the effect, if any, of orthodontic appliances be realised. She emphasised that each case must be considered individually, and when early treatment was decided, the growth of the child, the position and movement of the tooth germs, must be kept under surveillance in order to check any anomaly that might arise. For instance, narrowness of the maxillary arch in the region of the canines might give rise to an asymmetry of the jaws and face bones. She showed a case from Dr. Bustin's paper in which such a condition existed—the jaws on closing approached each other until the last moment, in a normal manner, but when the canines caught by reason of the constriction of the arch in that region, the mandible deviated to the left. There was asymmetry on that side of the head and face. Although expansion of the deciduous arch had been affected, it was obvious from the X-ray pictures that the position of the germs of the permanent canines had remained unchanged. A consideration of this case with that of the twin used as a control and untreated showed, from a comparison of measurements which were identical, that although the expansion of the arch in the former case had relieved the displacement of the mandible, the real increase in the arch was due to a growth-force which set in at the age at which the cases were studied, for the twin control showed practically the same increase. Another interesting point in these two cases was the spontaneous rotation of the germs of the permanent laterals from a sagittal to a frontal position, and that the expansion of the arch had no effect upon the floor of the nose. Other cases were cited in which expansion of the deciduous arch was advised: a narrow arch in which the permanent lateral erupting had pushed out the deciduous canine, and where, as a result, there would be a drifting forwards of the cheek teeth, including the first permanent molar, thus encroaching on the space for the permanent canine. Expansion in such cases helped to stimulate the growth-forces, and the best time for this was just before or at the time of the eruption of the permanent incisors, when the deciduous canines were intact and unabsorbed.

The main reason for the necessity to create room for the permanent

* Read before the British Society for the Study of Orthodontics, November 4th, 1935.

dentition, at whatever time, was shown in those cases where the molars had drifted forwards and had occupied the space for the canines and premolars. Dr. Bustin discussed the question of extraction in such cases and decided that when the germs of the widsom teeth were situated too close to those of the second permanent molars, extraction was the only course ; but he felt in other instances that when treatment had been undertaken, early extraction should be avoided and retraction of the molars carried out. In some cases, as when the lower second deciduous molar had been lost early, the second premolar erupted prematurely and the upper deciduous molar occluded with it in such a way as to prevent the lower first permanent molar from tilting forwards. In most cases, however, early loss of the deciduous canines led to a drifting forwards of all the cheek teeth ; expansion of the arch did not improve this condition and the correct treatment was to retract the cheek teeth. It was important to choose the correct moment for this, generally when the premolars were about to erupt, the age varying according to the individual. By correct timing, the forward movement of the molar was held in check and the space could be retained until the premolars had taken up their position in the arch. Another point to study was the stage of development of the second permanent molar—the most favourable time being before the formation of the roots of that tooth, for when that tooth had advanced sufficiently in the course of development and had started to erupt, there was a greater resistance to distal retraction and as a result a greater force must be exerted by the orthodontic appliance used. Again, after the retraction, the developing germ and its eruption exercised a favourable influence upon the deposition of bone at the posterior part of the jaw. When the premolars were in course of eruption, as a rule only the crown of the second permanent molar had developed—the roots were only starting to form. There were cases, of course, in which the eruption of the second molar was coincident with that of the premolars ; these cases must be considered individually and the right time chosen. Dr. Bustin then considered retraction of the cheek teeth by means of the lingual arch compared with the head-cap and traction, and showed that in cases where the former had been used there had invariably been tilting of the roots of the teeth, whereas with the steadier, if more tardy, effect of the head cap and traction, the teeth had been pulled backwards bodily, without any tilting. The advantages claimed for this were (1) the apparatus was more simple—no danger of broken springs ; (2) the treatment was more simple, and could be undertaken by the general practitioner who had not specialised in orthodontic appliances ; (3) reduction of the number of visits from the patient ; (4) the pressure was slight, continuous and equal, in contrast to that of springs, the adjustment of which was always a difficulty for the less proficient ; (5) avoidance of mesial traction on the anchor teeth ; (6) the teeth were moved bodily and not tilted ; (7) movement of the cheek teeth together with the anterior teeth at one time, in contrast to the isolated retraction of the molars and need for their retention when the lingual arch was used. It had this disadvantage —that the treatment was spread over a longer period.

Discussion.

The President said he was rather disappointed not to see the head-

cap and band, but Mrs. Lindsay had presented a very interesting paper.

Mr. Russell Marsh said he would like to thank Mrs. Lindsay for a very valuable paper. If by accident the six-year-old molars had very unfortunately moved forward, through early extraction of the temporary teeth or perhaps through neglect to put in a temporary appliance to prevent the teeth moving forward, he did not see any reason why orthodontists should not make an attempt to push those teeth back into their proper position and to allow of correct eruption of all the teeth in the arch. He did not think one was justified in removing teeth in the front of the mouth if the six-year-old molar could be moved back. It was a very difficult matter to move back a six-year-old molar. Dr. Bustin had pointed out one means of doing it and he deserved praise for that ; whether his ultimate results were entirely successful or not remained to be proved. Personally he thought that the X-ray photographs showed, on the whole, a very good result. He would like to have seen the apparatus itself.

Mr. Harold Chapman, referring to the statement in the paper that the laterals changed from a sideways position to a frontal position during development, said he did not recall having seen that happen, and he thought it was a question that might well form the subject of research. X-ray photographs could be taken of a number of laterals, and the change in position, if any, noted. He understood Mr. Russell Marsh did not agree with him in regard to the pushing back of the molars. He would like to ask him whether, in an otherwise normal case, where, say, one first permanent upper molar had moved forward nearly to the first premolar, he would advocate treatment for the pushing back of the molar to make room for the premolar. He thought the members were very much indebted to Mrs. Lindsay for her excellent translation of Dr. Bustin's paper, and he wished to add his personal thanks to those already expressed for her valuable contribution.

Mr. H. G. Watkin thanked Mrs. Lindsay for the work she had done in preparing her paper. With regard to the pushing back of the molars, he thought that the age of the patient was a very important point in that connection. If the child was very young, say 7 or 8 years of age, he thought it could be done, but after that age one might regard the malocclusion as confirmed and the pushing back of the molars was practically impossible.

Mrs. Lindsay, in replying to the discussion, said she had felt very diffident in bringing the paper forward, but she had always thought that it was a good thing for orthodontists in this country to know what those in other countries were doing.

She had always understood that when the deciduous molars were lost early, it was not quite exact to talk about the drifting forward of the permanent molars ; it was more of a tilting. If these were brought back, surely the space was regained which had been lost by the tilting.

With regard to the point made by Mr. Chapman about the laterals, she thought that was very important. Some of the members had seen Professor West's specimens ; Professor West was quite sure that in the early stages the germs of the permanent laterals were in a sideways position and he had one or two cases in which the jaws showed the crypts of the permanent laterals distinctly in that position.

With regard to the age at which the molars were pushed back, that was the great point of the paper. As Mr. Watkin had said, that treatment must be undertaken early in order to obtain favourable conditions for moving back the teeth that were tilted forward. It was the extraction of the deciduous molars between 3 and 4 years of age which caused the drifting or tilting of the six-year molars when they erupted.

TWO CASE REPORTS.*

By H. G. Watkin, L.D.S.Liv.

Case I.

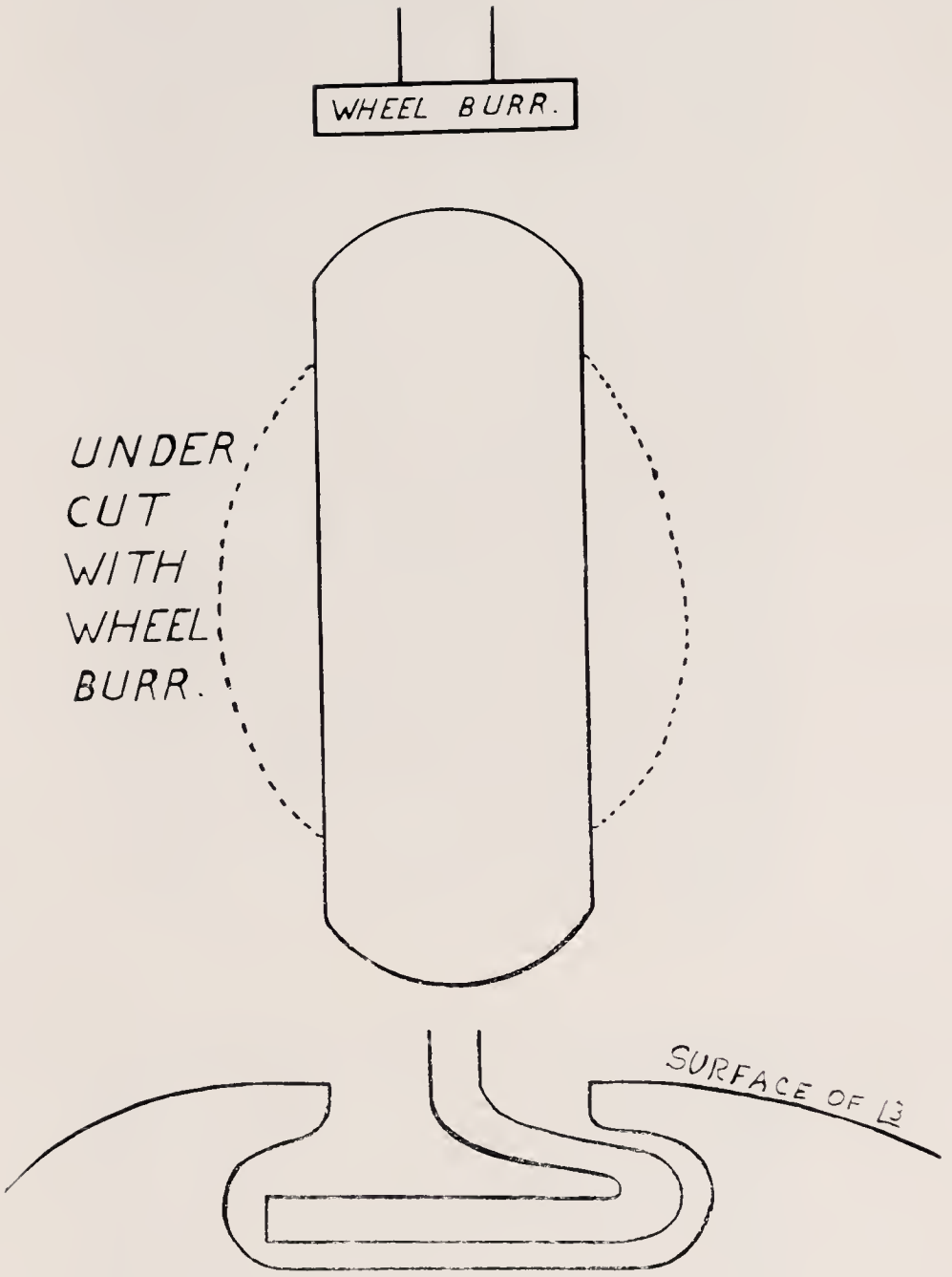
This is the case of a girl aged 22 who was sent to me because a canine was missing and the upper left lateral incisor was quite loose. Fig. 1 is an X-ray photograph which reveals the original condition. The canine is continually erupting and is just about to cause absorbtion of the root of $\underline{|1}$. Of course, the obvious treatment was to remove the lateral incisor and bring the canine down into position. I show you this because I have a rather simple method of attaching a pin to a canine.

Case I. Fig. 1.

I drill a small hole in a suitable position and then, with a wheel burr, put undercuts in the substance of the tooth (Fig. 2). Then I get a piece of very small gauge (0.3 or 0.4 mm.) stainless steel wire and bend a T on the end of it and make the hole oblong. I put the T in so that it goes in the oblong way and turn it through a right angle, so that it engages the undercut part.

When turned at right angles it is quite impossible to pull it out, even when no cement is used. If you like you can put a little amalgam round, instead of cement. I put the pin in at the first operation, when bleeding has not stopped. When the tooth has come down a little further, in a few weeks' time, the pin can be

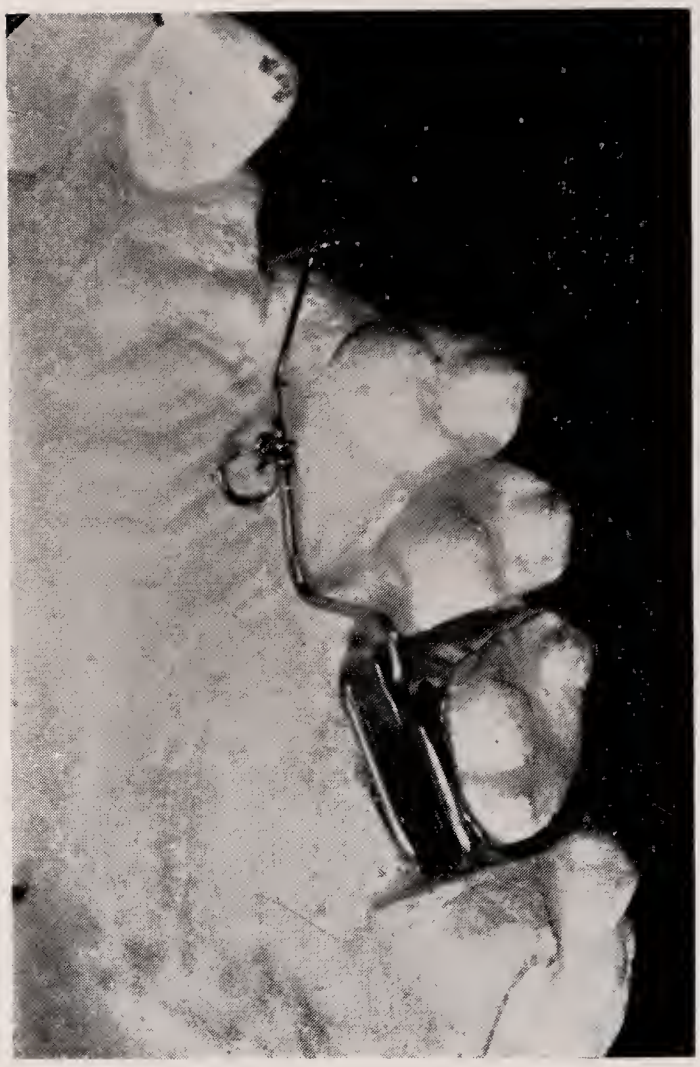
* *Transactions* of British Society for the Study of Orthodontics, Dec., 1935.



Case I. Fig. 2.

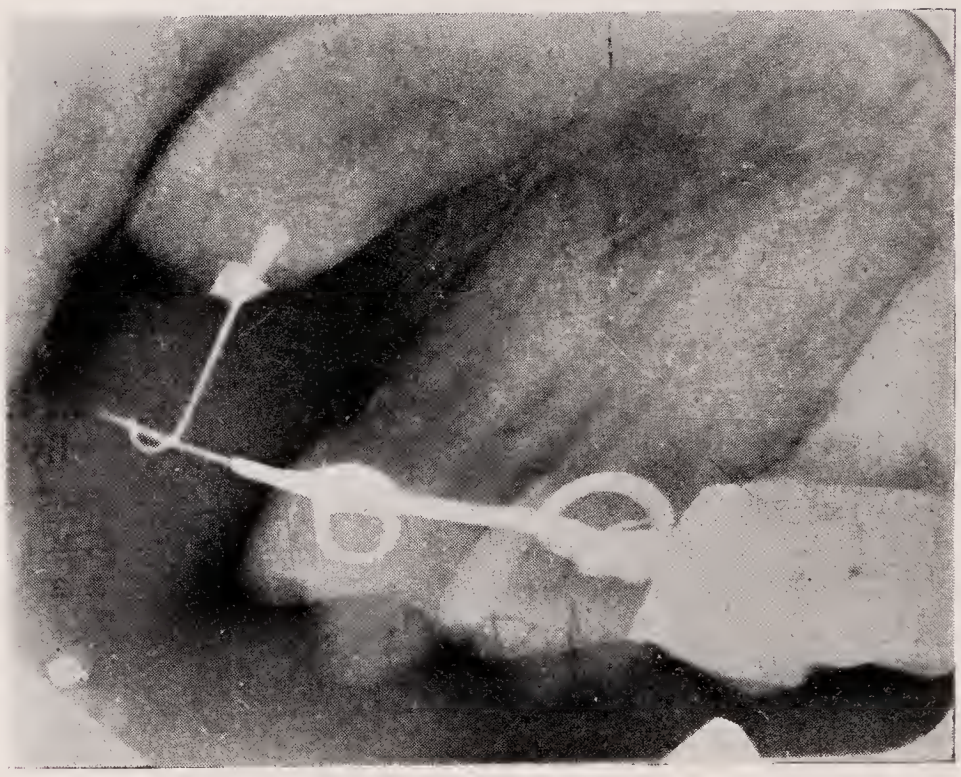
removed and a good sealed joint made. If any of you have tried to cement a pin in a tooth in the palate you will know it is not an easy matter, especially if the tooth is lying deeply embedded.

In this particular case I managed to cement it in. I have done several cases since this one, using the method I have just described. The molar is banded and a piece of 0.8 mm. wire is rigidly attached to the band with a Simon lock. A smaller piece of wire is welded to it, and the hook on the exposed end of the wire, attached to the tooth, is bent in such a position that it cannot untwist and become loose. As long as the T is at right angles to the position at which you push it in, it will not pull out. As the tooth comes down, you cut the end off the exposed piece of wire and put a new hook on, shortening it at each visit, until there is only just room for a finger spring.



Case I. Fig. 3.

Fig. 3 is a picture of the model, with the apparatus *in situ*. The pin is attached to the tooth.



Case I. Fig. 4.

Fig. 4 is an X-ray with the apparatus *in situ*.

Case I. Fig. 5.

Fig. 5 shows the tooth after it has been brought down into position. There is a small filling in the hole where the wire was attached.

Case I. Fig. 6.

Fig. 6 shows models at three different stages: first, after the lateral has been extracted; then when the canine is about halfway down, and then the final stage. The tip has been ground off the canine to make it look something like a lateral incisor.

Case I. Fig. 7.

Fig. 7 shows the final occlusion, with the canine in position. I have another case.

Case II.

It rather bears out some remarks made by Mr. Russell Marsh on a previous occasion. Unfortunately I did not take the original picture myself. Fig. 8 is taken from a group of the family, and shows the full view of the child. It is a very bad case of thumb-sucking.

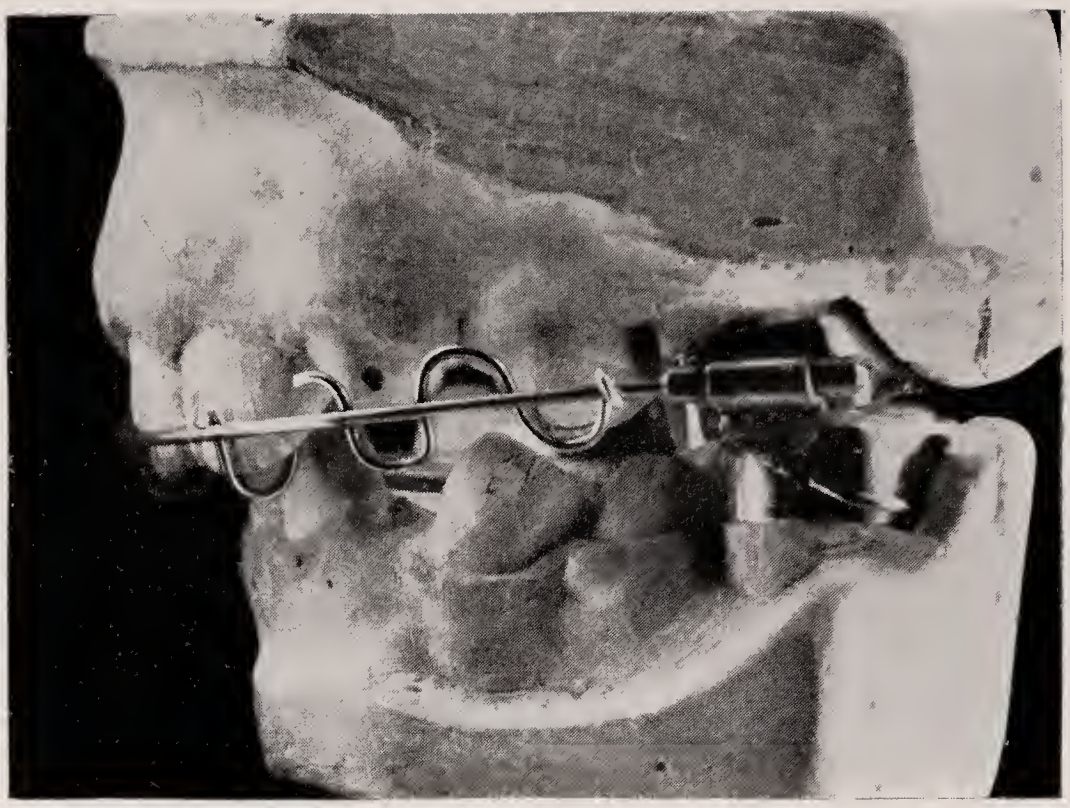
Case II. Fig. 8.

Case II. Fig. 9.

I want you to notice particularly the tremendous amount of superior protrusion of the upper jaw (Fig. 9). The lower incisors have retruded. All the teeth are present.

Case II. Fig. 10.

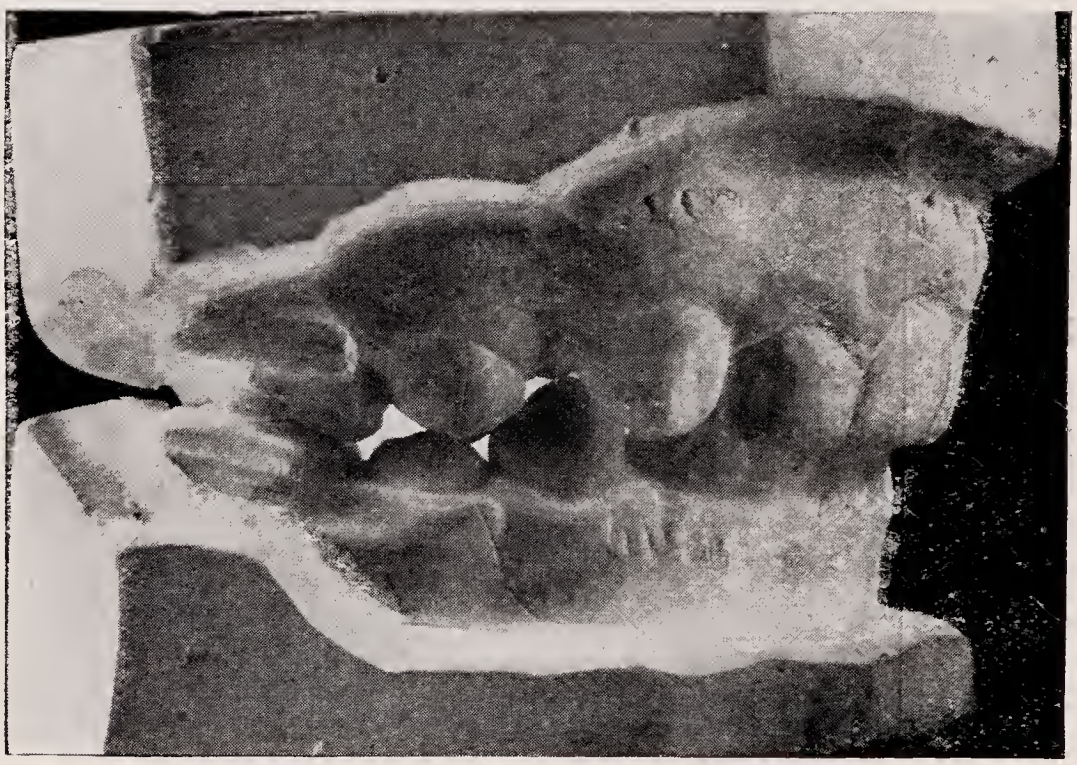
Fig. 10 shows the method of correction adopted. There are spurs on the four incisors. The passive position of the bow is about 2 mm. higher in front than the active position.



Case II. Fig. 11.

Fig. 11 is a side view of the same bow in position. The spurs are now exerting an upward pressure on the incisors. There is a lower lingual bow.

Intramaxillary traction was used in this case. The straight piece of free metal in front of the facial tubes is to allow the bow to move distally.



Case II. Fig. 12.

Fig. 12 is a front view, showing the upper incisors right back, up against the lower incisors. The lower lip cannot get behind the upper incisors ; it must go in front.

Fig. 12 was taken some three years ago. I saw the child about six months ago, and the position of the teeth is the same, except that the gaps $\underline{4 \mid 4}$ have closed up a little more.

Case II. Fig. 13.

Fig. 13 shows the profile when the case was finished.

Discussion.

The President remarked on the extreme lucidity with which Mr. Watkin had shown the two cases. Those members who had had the privilege of seeing Mr. Watkin at a demonstration, would not be surprised at the extraordinary ingenuity of his mind in dealing with small problems as they arose.

Mr. Russell Marsh, referring to the first case shown by Mr. Watkin, said he would have felt rather nervous about using only one six-year-old molar as anchorage. He would have been afraid that he might get tilting of that tooth, because a canine tooth presented a tremendous amount of resistance. He would have expected a little tilting forward of the six-year-old molar and possibly of the 2nd and 3rd molars as well.

Mr. F. Bocquet Bull thought that the canine tooth might have been given an opportunity to erupt by itself, before an apparatus was used.

Mr. H. G. Watkin, in reply, said that the canine was impacted on the central incisor, and the central incisor was slightly absorbed. The patient would soon have lost the central incisor, the lateral incisor and the canine. He had had one case in which that had actually occurred. The lateral incisor dropped out itself, and the patient came to the hospital. The canine was too high up for it to come down without the use of an apparatus.

CASE REPORT.*

By J. Sturrock, L.D.S.St.And.

I first saw this patient in December, 1931, when she was ten and a half years old. The appearance of her teeth at that time is shown by illustrations 1, 2, 3, 4. The upper teeth were crowded with the second premolars instanding and the first permanent molars rotated ; the lower arch looked normal but was in distal relationship to the upper to the extent of one unit. There was an open bite in the incisor region. She appeared to be a mouth-breather and had a short upper lip. The patient's doctor could find no obstruction to nasal breathing. It was decided not to attempt to correct the mesio-distal relationship, but to compensate for this by removing one cusp from the upper arch on each side. It would have been simplest to extract the instanding second premolars, but as the first premolars had each a small cavity they were removed.

Fig. 1.

Fig. 2.

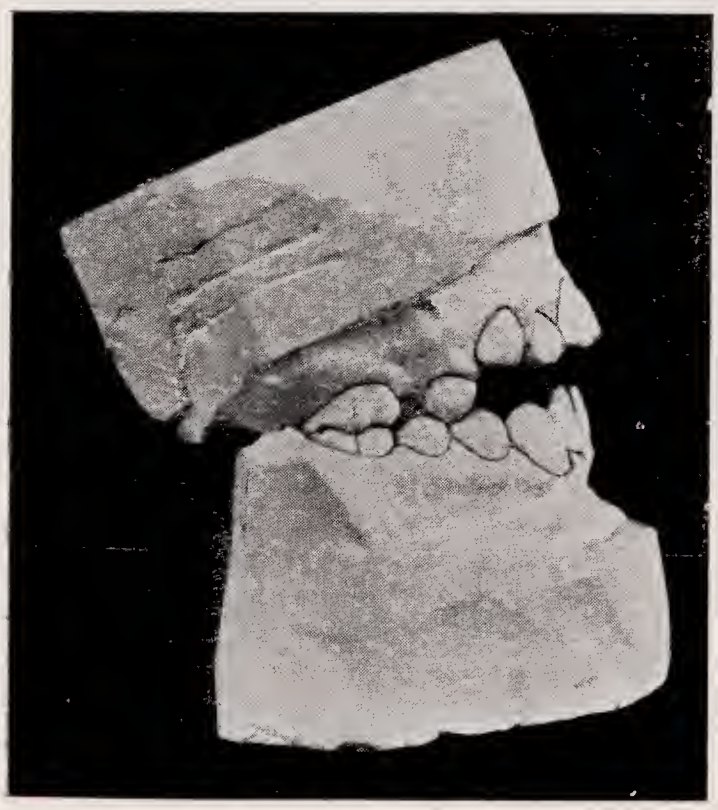


Fig. 3.

Fig. 4.

* Read before the British Society for the Study of Orthodontics, Dec. 1935.

To improve the lip relationship the use of a lip disc was advised.

An appliance of the type described by Miss Smyth was fitted to rotate the molars. A month later finger springs were added to move the premolars labially, continuing the rotation. Two months after this a high labial arch was added with finger springs to reduce the labial inclination of the incisors. Within eight weeks the patient could bring her upper and lower incisors edge to edge. Figs. 5, 6, 7, 8.

The arch wires were reshaped to serve as retainers, and in December, 1932, one year from the start of the treatment, all apparatus was removed, but in case mouth-breathing might still

Fig. 5.

Fig. 6.

Fig. 7.

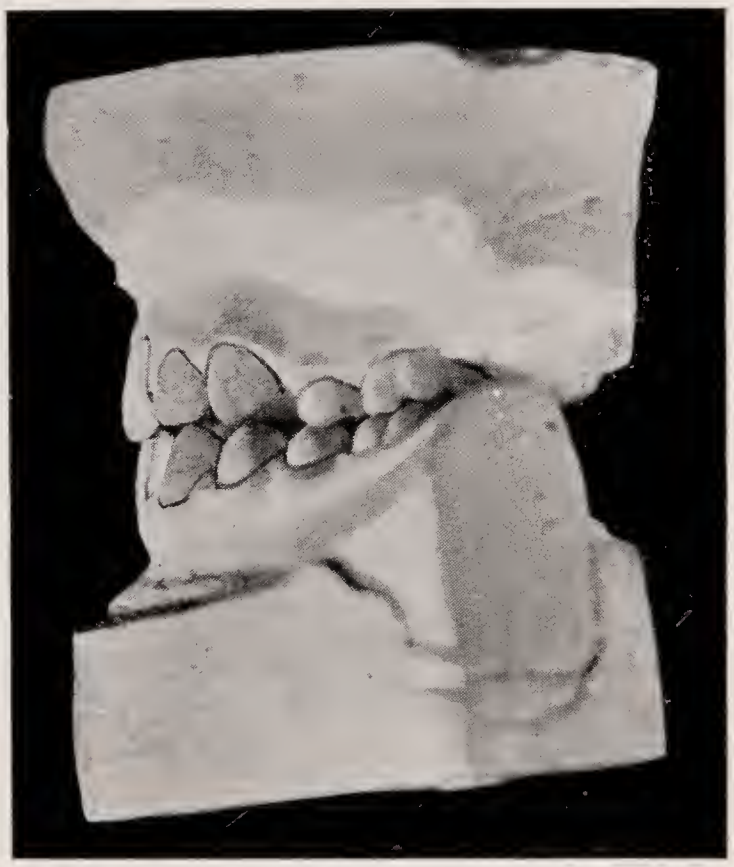


Fig. 8.

be present, a vulcanite oral screen was made to be worn at night for three months.

The patient now lives too far from London for impressions to be taken, but her mother assures me that very little relapse is apparent and that she can bring her upper and lower incisors edge to edge.

Discussion.

The President said that Mr. Sturrock had shown an exceedingly successful case.

Mr. H. G. Watkin inquired whether Mr. Sturrock had asked the child to swallow and had noticed whether the tongue protruded in the act of swallowing.

Mr. Russell Marsh said that he was struck by the fact that Mr. Sturrock had not actually with an appliance elongated the upper incisors, but in point of fact they had come down by themselves within reach of the lower incisors. Mr. Sturrock had reduced them by moving them backwards but had not actually elongated them. It struck him that it had been probably the lower lip that had kept the upper incisors from fully erupting, and that, when by his treatment Mr. Sturrock had prevented the lower lip from getting in between the lower incisors and the upper incisors, the upper teeth had been able to erupt. He thought that if the tongue had been responsible for the condition the treatment would not necessarily have prevented that action.

Mr. H. Chapman asked if there was any history of finger or thumb sucking in the case, as it appeared to be of the type in which that had often been an ætiological factor. He congratulated Mr. Sturrock on the very excellent rotation of the molars which he had obtained.

Mr. Franklin Turner said he had had a case of a child whose age, he thought, was about seven years when the treatment was commenced, and the history was one of very late persistent use of the dummy. It was quite obvious that, when the dummy was taken away, the child's tongue took up the space between the erupted deciduous teeth, and a habit was formed of the tongue being forced through. Upper expansion was necessary, and a Badcock plate, without any inclined planes, was placed in the mouth. The thickness of the plate seemed to be sufficient impediment to the tongue to cure the habit that had been formed, and the teeth erupted, and within, he thought, twelve months the condition of open bite, about one eighth inch, in the erupted second teeth, was cured, a very good result being obtained.

Mr. R. G. Daplyn said that Mr. Sturrock had stated that the child had a very short upper lip when he commenced treatment and also that he retracted the upper incisor. That almost invariably tended to elongate the teeth. He would like to know what the ultimate condition of the mouth was as far as the lip was concerned.

Mr. J. Sturrock, in reply, said that at the time he did not investigate the case very scientifically, the patient having been sent to him only for the treatment in question, but there was no history of thumb sucking. The mother could offer no explanation of the condition. The child had an expression as if the mouth were half open and the upper lip too short. At the end of the treatment he did not think she showed a great deal of tooth. Her lip certainly seemed to have lengthened, and she had a more normal appearance at the end of the treatment than at the beginning. The card held between the lips to encourage her to keep them in a normal position was an important part of the treatment, and the oral screen to encourage her to breath through the nose and thus keep the lips in the right position was also an important part of the treatment. He knew that he ought to have made fuller observations, but he had not done so at the time.

CASE REPORT.*

By L. Russell Marsh, L.D.S.Eng.

This is the case of a boy of 19 years of age. As you can see, it is a case of gross postnormal occlusion, in which four premolars had been removed. It had this advantage, that the boy's mother said she knew it was a hopeless case, and if I could do anything at all she would be grateful. That is always very good basis on which to start an orthodontic case !

I began by expanding the arches, which were very narrow, and retracting the upper incisors as far as the space would allow ; in other words, getting the upper canines fully back into the spaces which had been provided for them. There was then still a considerable amount of postnormality, and to my mind it was unthinkable that one should remove another two premolars. I undertook intermaxillary traction with considerable trepidation, and I was rather surprised and pleased with the result. There is no comfortable occlusion other than that shown in the final models, and there has been, so far, no indication of a tendency to relapse since the retainer was removed some months ago. The movement in this case has been a bodily movement of the whole mandible, rather than alveolar movement, as the period of intermaxillary treatment was of comparatively short duration.

The case is not completely finished at the moment. I am just moving back the right canine tooth into a little space which has been left by a Hawley retainer that the boy has been wearing, and I am elongating both the upper second premolars, so as to lock the bite completely.

Some of these apparently hopeless cases are not as hopeless as they seem. Unfortunately this boy has a very receding chin, and his appearance does not look quite so much improved on the whole as the side view models would indicate.

Fig. 1.

* Read before the British Society for the Study of Orthodontics, Dec., 1935.

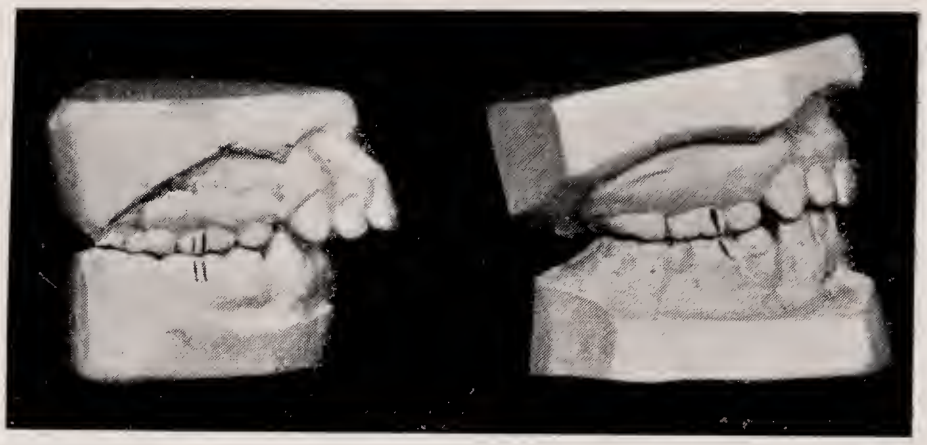


Fig. 2.

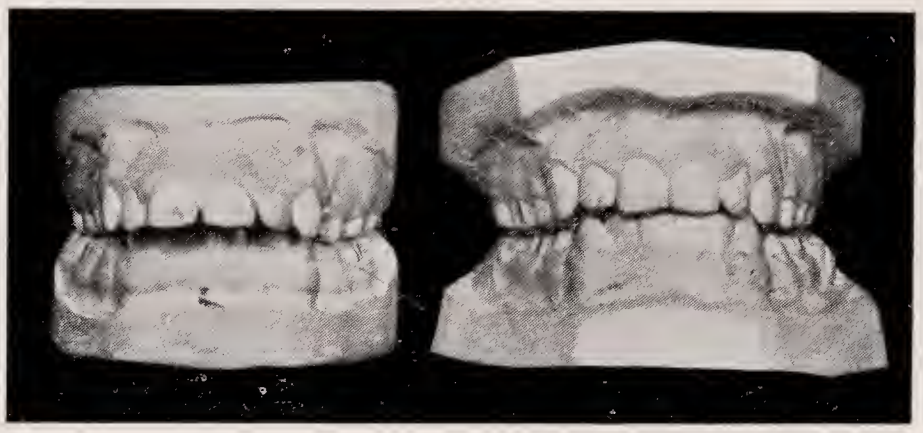


Fig. 3.

Discussion.

The President said that Mr. Russell Marsh had shown the members an ingenious little gadget.

Mr. H. C. Visick said he could not help feeling that the reason why the canines in Mr. Russell Marsh's cases did not expand with the rest of the teeth was that his plates did not fit firmly enough. Mr. Russell Marsh had said that he was not very keen on using cribs or bands, but relied on the knife edge of the upper plate or of the plate fitting at the neck of the tooth. Personally he had seen plates like that, but he always felt that they were not as firm as they ought to be. He was a great believer in cribs and also in lingual spurs, and he had not noticed that the canines did not widen. He felt that he wanted to go home at once and measure some of his models to see whether that was so or not, but he believed that if the plate went in and gripped in tightly the slope of the canines would not matter. The plate resting on that slope would work quite as well, and there was no reason why one should not put a lingual spur under the slope of the canine. If he wanted to get one tooth further than the rest—if he wanted, for instance, the first premolars to expand further than the rest of the teeth—he kept on bending out his lingual spurs.

Mr. H. G. Watkin thought Mr. Russell Marsh had obtained a very good result. He had had a similar case, and he had extracted the upper second premolars. Somebody had removed four premolars, making the case no better, of course, and he took two more premolars out in order to get the molars against the canines.

In reply, Mr. Russell Marsh said that he did use cribs and retention devices wherever necessary in removable appliances, and only suggested that if the plate be properly trimmed it would fit quite well without. At the average age of a patient under treatment, even the Visick crib is impracticable on the lingual surface of the canine, the cingulum of which is too far below the level of the gum.

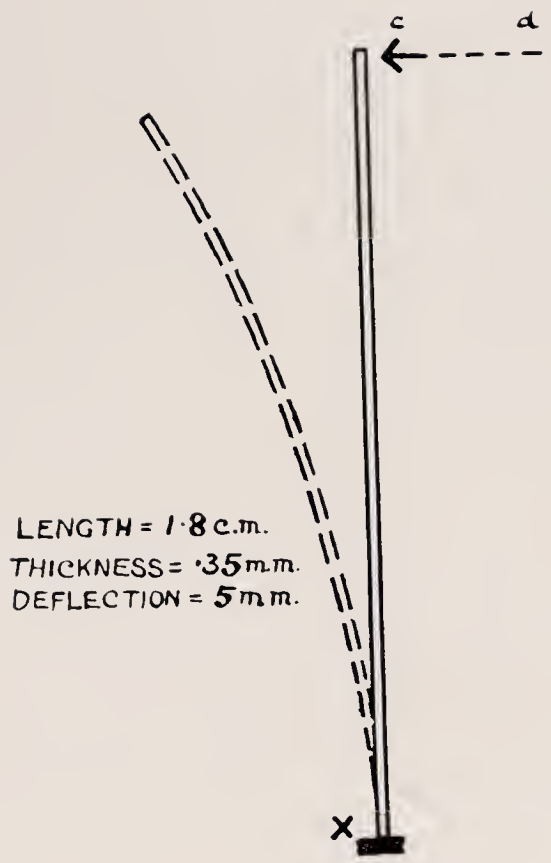


FIG. 2. Diagram of straight spring fixed at X, free elsewhere, deflected by pressure initially applied along c - - - - d.

Now the only statement of the amount of pressure that ought to be used on teeth which has any definite basis is that of Martin Schwarz. The amount given by him is 20 gms. per single-rooted tooth as a maximum. That need not be accepted as final, but it does agree very closely with the figure that my own clinical experience and that of some others dictates, so I shall take that figure as a provisional maximum. If you apply 20 gms. pressure at right angles to the end of the spring we are considering, you get a deflection of about 5 mm. (The actual amount will vary with the material of the spring, but that figure of 5 mm. can be taken as typical.) The position now is that the spring is exerting a pressure of 20 gms. and that to get back to its position of rest the point on the spring where the pressure is being exerted must travel 5 mm. But as it progresses towards its position of rest, the pressure exerted constantly diminishes, so that before the full travel of 5 mm. is completed the pressure will probably have fallen below the minimum necessary to produce movement of a tooth. That minimum necessary to carry on tooth movement is a very variable thing, so that one cannot say at what point in the spring travel tooth movement would actually cease, but the essential point is that one cannot count on the movement range being equal to the spring range. There is another factor which commonly creates a greater discrepancy. Teeth in movement frequently meet with opposing pressures from muscles, either active or passive, and the amounts of these pressures may be substantial. These opposing pressures neutralise the artificial pressures applied to produce movement, so that the net pressure may well fall to half the gross artificial pressure at an early stage of movement. In that case, when less than half the spring travel has been covered, artificial pressure will be completely neutralised and tooth travel will consequently be less than half. That is

possibly an unusual degree of neutralisation, but in expansion in deciduous molar, premolar and canine regions, probably the average tooth travel is only about two-thirds of spring travel where pressures of the order of 20 gms. per tooth are used. Further, mechanical obstacles to movement, such as cusp interdigitation, frequently neutralise artificial pressures and consequently tend to limit the effective range of springs. It is evident, then, that where we want 5 mm. tooth movement we shall have to choose a spring such that when 5 mm. have been covered it will still have sufficient pressure stored to balance any inertia or opposing pressure that it may meet in use. What that residual pressure needs to be depends of course on the individual case.

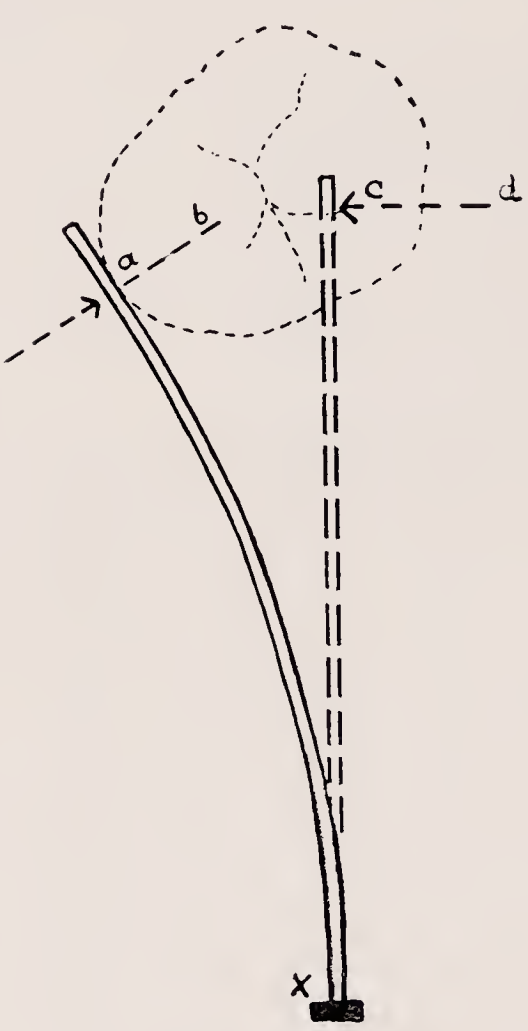


Fig. 3.

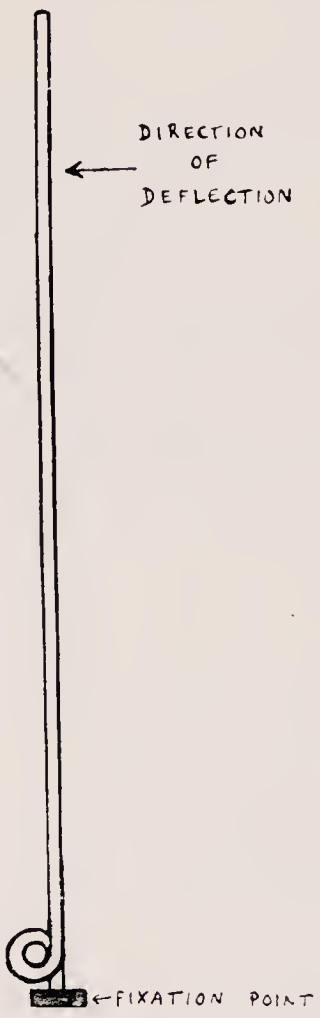


Fig. 4.

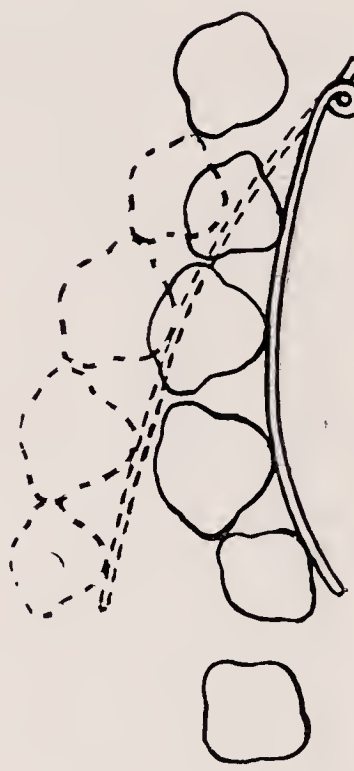


Fig. 5.

FIG. 3. Direction of action changes from a-b to c-d between full deflection and position of rest.

FIG. 4. Coil inserted as near as possible to point of greatest bending stress to distribute stress over greater body of material, and so avoid liability to deformation.

FIG. 5. Unequal movement of teeth near and remote from point of fixation of single spring.

Let us see what the need for a residual pressure at the end of tooth travel implies. Referring again to the specimen spring, you will remember that the initial 20 gms. would all be expended at 5 mm. travel. If you wanted to have 5 gms. unexpended at 5 mm. travel you would have to store 25 gms. initially, and that would involve $6\frac{1}{4}$ mm. deflection. Unfortunately the need for a compromise in the material used for springs between elasticity and ductility results in the elastic limit being reached in a spring of these dimensions very close to 5 mm. deflection, so that $6\frac{1}{4}$ mm.

will produce a permanent bend. The spring refuses to store the full 25 gms. required. If, however, we increase the length of the spring considerably and the thickness slightly we can get the needed deflection and pressure, but we come here against one of the standing difficulties of design, the difficulty of getting a point of fixation for a spring sufficiently remote from the point of application to allow the ideal spring length to be used. The length I chose for this spring we have been examining, 1.8 cm., is not the greatest length it is possible to use in the mouth, but it does represent a sort of mean high-tide of distance it is convenient to get between point of fixation and point of application.

There is another characteristic of this form of spring which has considerable importance. As the spring deflects it curves, and since action and reaction between tooth and spring are always at right angles to the surface at the point of contact, the direction of movement of the tooth at maximum deflection will be along the line A—B (Fig. 3), while as the position of rest of the spring is approached the direction becomes that of C—D ; but the original direction is such that the tooth is tending to move further from the point of fixation of the spring, and consequently opposite a still more deflected surface, or, if the wire stops just beyond the original point of application, the tooth loses contact with it altogether. As the positions of neighbouring teeth are frequently such as to prohibit any but a short extension of the wire beyond the point of application, this liability to lose contact is, where the initial deflection is large, a very real risk.

There is a slight but valuable alteration which can be made to the form of the spring (Fig. 4). The introduction of a coil as close as possible to the point of fixation aids in the distribution of the bending stress, where it is at a maximum, over a larger body of material, and consequently reduces the tendency to permanent deformation. This is the most important function of the coil, but it also slightly reduces the change of direction between maximum deflection and position of rest.

I have been dealing with this form of spring as applied to single teeth. If we apply it to the movement of a group of teeth distributed along its length we find the most significant characteristic is the very great difference of travel it imposes on teeth near and remote from its point of fixation (Fig. 5). The greater the difference of the distances between the individual teeth and the point of fixation, the greater will be the disparity of their travel, so that if we get a point of fixation sufficiently remote from the nearest tooth the disparity could be made negligible, but since the fixation point is in practice determined by the necessity of accommodation in a functioning mouth, there are very narrow limits to the possible extension of the spring. Since the number of cases in which the teeth of a group require widely different distances of movement in the order which the form of this spring dictates is small, this characteristic is a great obstacle to its general use on groups of teeth. Where it is thus used, frequent alteration both of form and point of fixation is rendered necessary.

There is another form of spring with whose characteristics I wish to deal shortly (Fig. 6). One end here again is fixed, and the spring is free elsewhere, but the behaviour of the spring is as if

there were two springs, one fixed at A and the other fixed at X.

Each of these springs taken separately shows the characteristics of the single spring which we have been investigating, but the fact that they run in opposite directions results in the reversal of their actions, so that when they act together the changes of direction which occur where a single spring is moving from deflection to rest cancel out. Thus if a spring of this form is applied to teeth at X and Y, and the position of rest of the spring is at right angles to the direction of movement, then the teeth will be moved equal amounts in the same direction. The same is true where the number of teeth is more than two.

There is another feature of the behaviour of this form of spring which is of some importance. If the spring is deflected and applied to a single tooth at some point between X and Y, the deflection can be more for a given pressure and thickness of material than it would be were a single spring used with the same points of fixation and application. In terms of practice, where a limited distance is available between the most remote point where a spring can be fixed and the tooth to which pressure is to be applied, an approximation to this form makes possible a greater range of movement, with a reduction of the change of direction of movement proportionate to the distance of the point of application from X.

To summarise what has been said about spring behaviour in relation to tooth movement :—

The conditions which favour the springs we have been considering are :—

Single spring.—Movement of single teeth ; Short distance of movement ; or Remote point of fixation available.

Double spring.—Movement of groups ; Movement of single teeth where no point of fixation is available remote enough to give the required deflection with a single spring, or where change of direction at the required deflection would be excessive.

To get deflections of the order of 5 mm. with the spring lengths available in the mouth, we require generally to use material of the order of .35 mm. thickness. Now 5 mm. is less than the mediodistal diameter of a small premolar, that is to say that in the mouth it is by no means the maximum distance we require to move teeth, and is less than half the maximum deflection we need to impose on springs in order to achieve the largest movements with the initial setting. And .35 mm., the diameter of the single spring we considered, is quite thin wire. In terms of inches it is .014, that is about 2/3 the thickness of the .022 in. wire which was widely used for auxiliary springs of gold-platinum alloy a few years ago. It is obvious that springs of this diameter, and the shorter ones of less diameter, are delicate things. A student, in order to know how far this must be considered a bar to their use, and in order to know how to safeguard them, must know to what stresses they are liable to be subjected in the mouth.

The teaching here should, I think, be somewhat on the following lines :—

That masticatory stresses may amount, in an adolescent, to a maximum of some one hundred kilograms, and are frequently of thirty to forty kilograms between molars. That they are at a

Fig. 6.

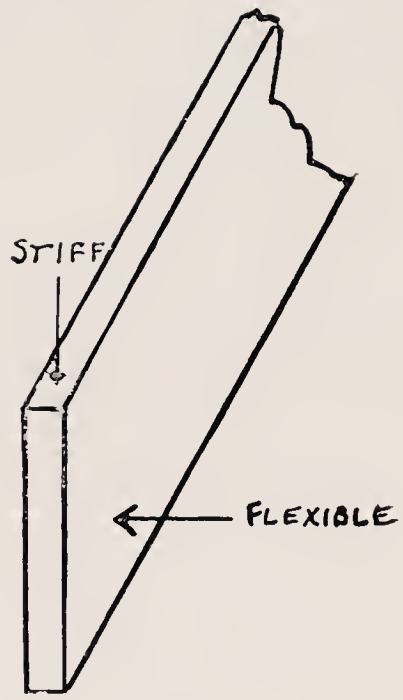


Fig. 7.

FIG. 6. Diagram of double spring, which acts as if it were two single springs, A—B and X—Y.

FIG. 7. Diagram of two-diameter spring material, giving flexibility in one plane, and stiffness in the plane at right angles.

maximum at the morsal surfaces and incisal edges, and since they are transmitted from those surfaces through food they diminish as the gum-margin is approached, but continue beyond the gum-margin for some distance. That even at the gum margin they are of sufficient magnitude to necessitate that springs which will deflect under a pressure of 20-80 gms. shall be protected. That the general direction of these stresses is uniform, so that protection is required in one direction only. That this protection may well take the form of a sufficiently rigid barrier between the spring and food passing off the masticating surfaces. That the other stresses to which springs are subject are those imposed by the tongue in its functions of exploration and dislodgment of foreign bodies. That these stresses are of much less magnitude, but may act over a much greater range. That absence of free ends to springs is an important factor in preventing displacement by the tongue. That since for the purpose of movement of the teeth flexibility is required in one plane only, it will be advantageous to make springs stiff in the plane at right angles to the plane of movement. That this can be achieved either by using material of different diameters as is done in the Ribbon arch (Fig. 7) ; or by using guides to restrain movement in any but the plane of tooth movement. That the usefulness of the former method is limited by the fact that material of this sort, if the difference of diameter is large enough to give a suitable combination of stiffness in one plane and flexibility in the other, when used near the gum margin, tends to interfere with the passage of food from the teeth via the gum margin to the palate or the sulci.

It is with knowledge of the sort that I have been illustrating,

but of course of much greater range, in his mind that the student should approach the selection of a source of pressure for whatever case he may have under consideration. Taking into account the number of teeth to be moved, and their grouping, the distances and the directions, and all the features peculiar to the particular case, he decides on the general nature of the source or sources of pressure. Its detail dimensions will be governed largely by the condition created by the nearness or remoteness of the fixation points available.

The diagram in Fig. 8 will indicate the range within which a choice of point of fixation could be made for a single spring were the action of the spring itself the only consideration. Since he can make a choice of any point in the circumference of the circle he can allow other considerations to dictate the actual point chosen. W would be a bad point of fixation on account of mastication and a few other things, but Z or Y or X may well be found to be the best suited to the particular case. Generally within the range available he will choose that where support and protection can be most easily obtained. If a point of fixation is not available sufficiently remote from the point of application to give the length necessary for range of movement and reasonable uniformity of direction, then a double spring may be substituted, when an even greater range of fixation points is available, in fact any point on a plane at right angles to the direction of movement of the teeth to be moved and as close to the teeth as possible. Use of a double spring to apply pressure to a group of teeth involves restriction of the range for the point of fixation to a plane at right angle to the direction of movement and a breadth equal to the height of the crowns. The necessity for support and protection commonly narrows this down to a strip near the gum margin, but with this form the fact that we can so readily get the required length without a remote fixation point makes the choice generally easy.

Where the features of the individual case make it necessary to use such a fixation point that the spring must be short, and a large deflection is required, a correspondingly thin material must be used. On the other hand, where length of spring or small range of movement permits, a proportionate increase of spring thickness will be advantageous. It is the conditions of the case itself which dictate all these features, but, I would emphasise again, a detailed knowledge of spring characteristics is necessary to design for the conditions.

There remains to be designed the framework which shall distribute to the movement groups and resistance group already arranged, the action and reaction of the pressure used. Obviously the student will find that its main outlines are already determined by its purpose. It must provide a firm point of attachment at the fixation point of each spring and it must transmit the reactions created by the pressure of the spring on the teeth without distortion. These considerations and the fact that it is exposed to the mouth-stresses already dealt with, indicate the rigidity necessary, and since they do in most cases indicate a high degree of rigidity it will be an obvious course to use the framework also for the protection of the sources of pressure, either by interposing it between springs and masticatory stresses or additionally by using the framework as a guide for the spring to prevent its movement in any but the plane

of tooth movement. This last method of protection has been initiated and mainly developed by Dr. Sheldon Friel, and as it has probably not reached its fullest application, can best be dealt with by examples (Figs. 9-14).

A—POINT AT WHICH PRESSURE IS TO BE APPLIED.

RADIUS OF CIRCLE = LENGTH OF SPRING.

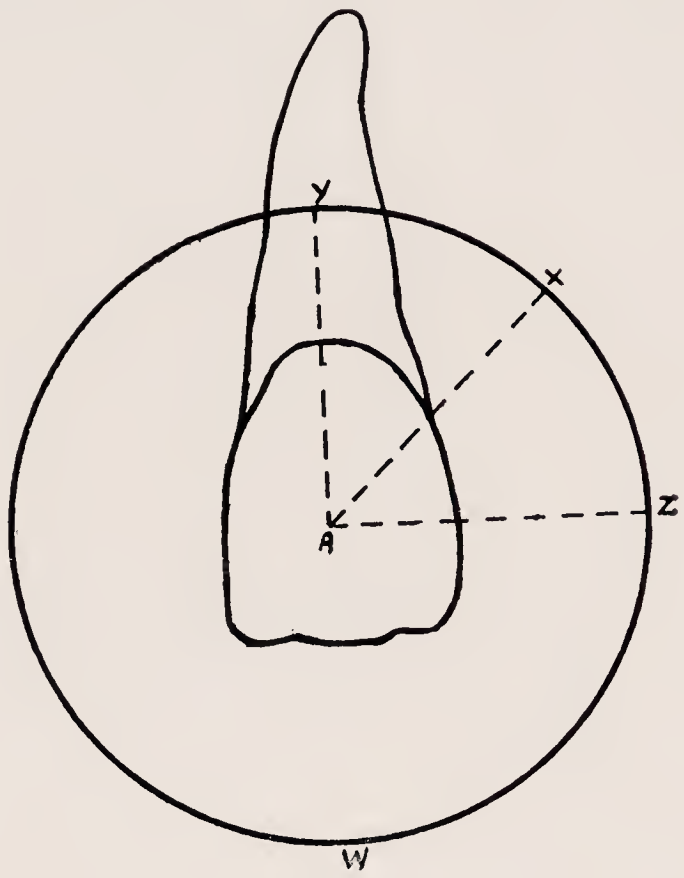


Fig. 8.

FIG. 8. Circumference of circle represents range of fixation points available for a single spring of length equal to the radius, to be applied at A. Fixed at any point on the circle it will have the same action.

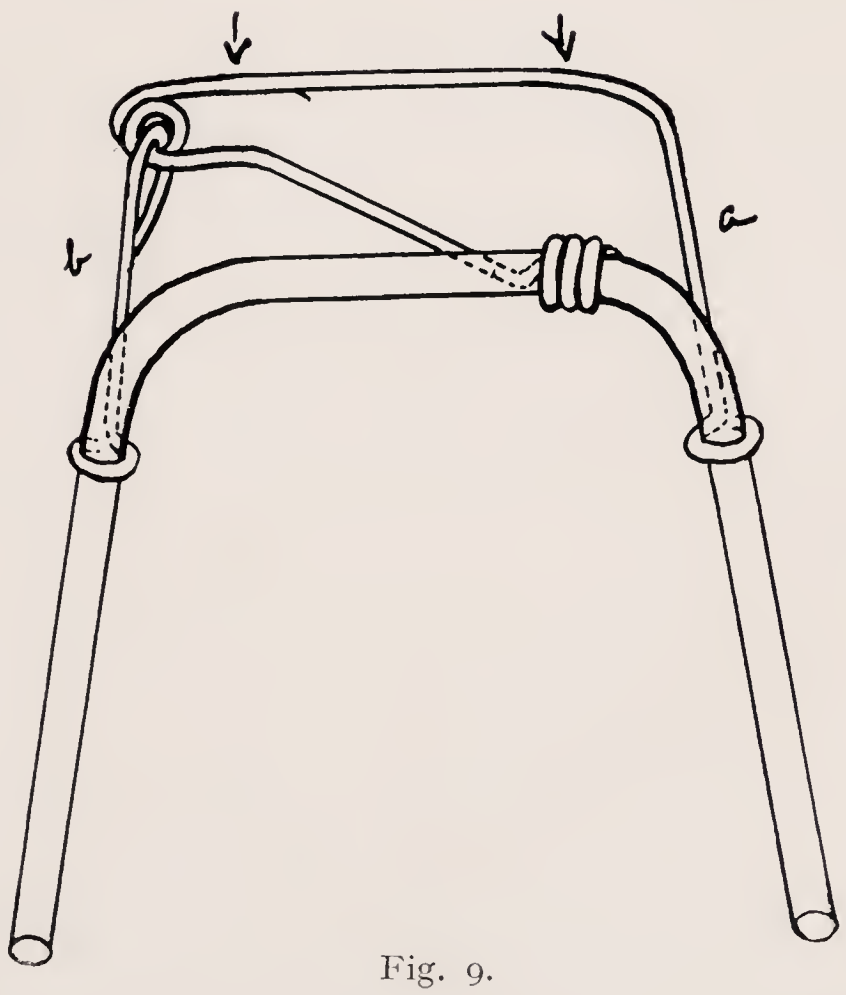


Fig. 9.

FIG. 9. The original "captive" spring "a" and "b," being in the line of action, do not functionally form part of the spring, but act as guides to confine movement to one plane.

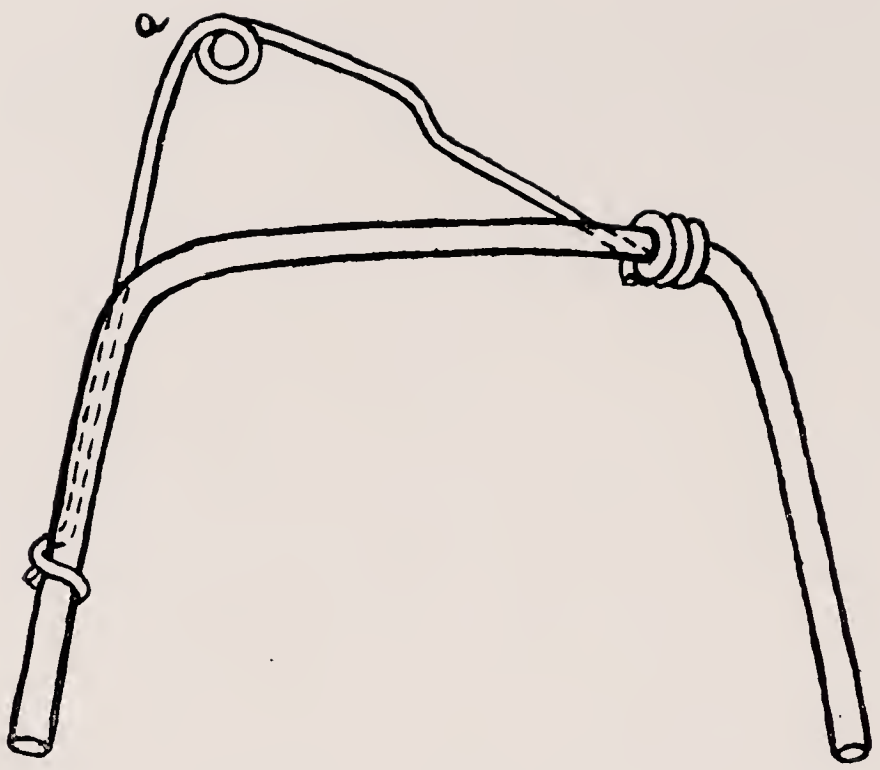


FIG. 10. The same principle as in Fig. 9 applied to a single spring. The coil at " a " allows change of angle between spring and guide, necessitated by the framework on which the guide works not coinciding with the natural path of the guide between deflection and resting positions of spring.

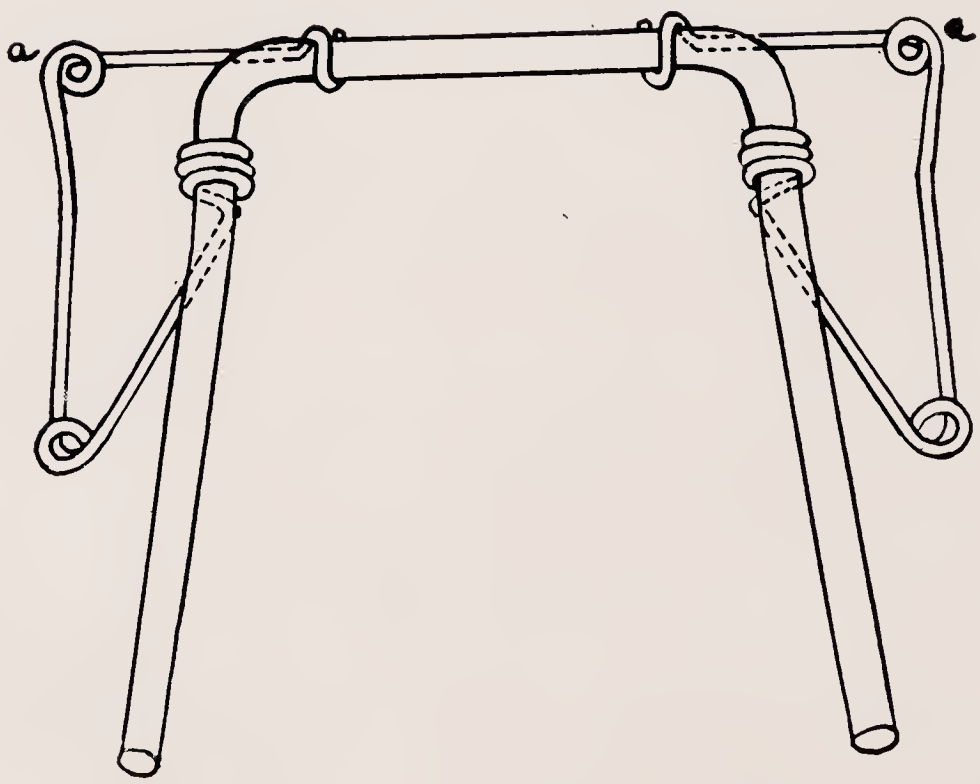


FIG. 11. The principles of Figs. 9 and 10 applied to expansion. Whether coils " a " are necessary or not depends on the actual direction of action of the springs relative to the alignment of the transverse part of the framework.

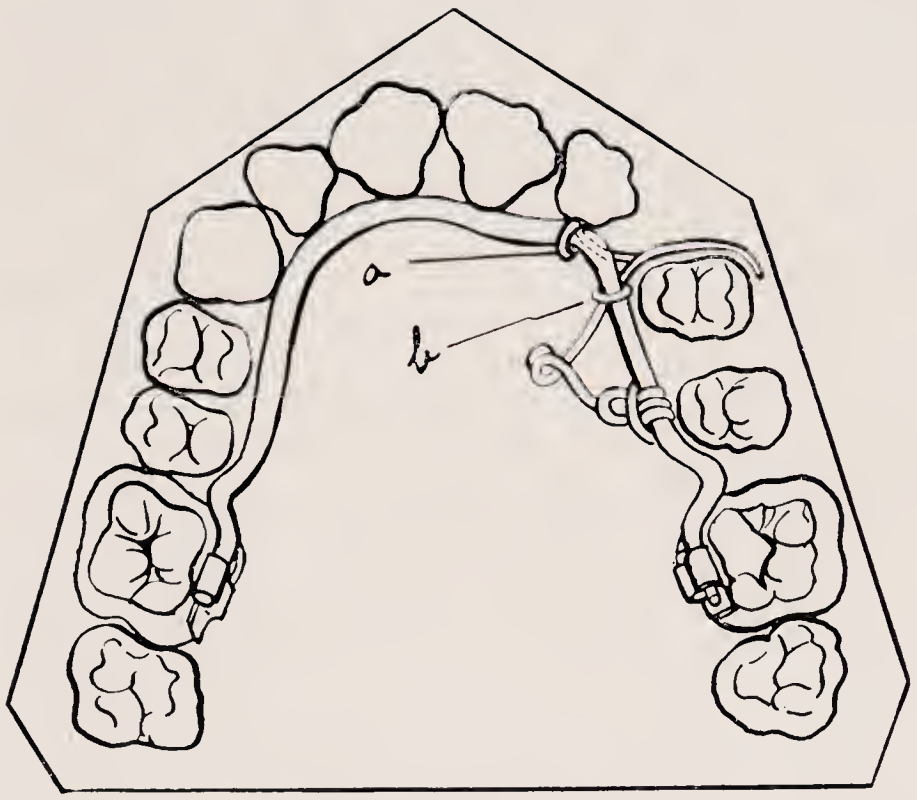


FIG. 12. Using the framework to prevent deflection of the spring in any but the plane of tooth movement, in distal movement of premolar. Guide "a" prevents deflection of the spring at "b," which would create an initial buccal component in the pressure.

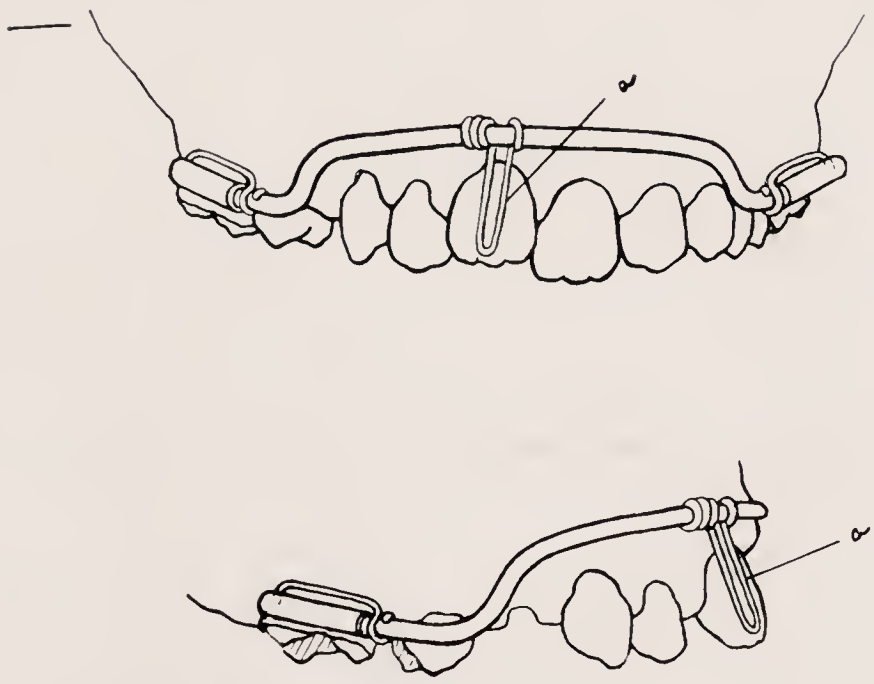


FIG. 13. Another method of preventing spring movement in any but the plane of tooth movement. Guide "a" can rotate on framework, but prevents labial displacement of spring.

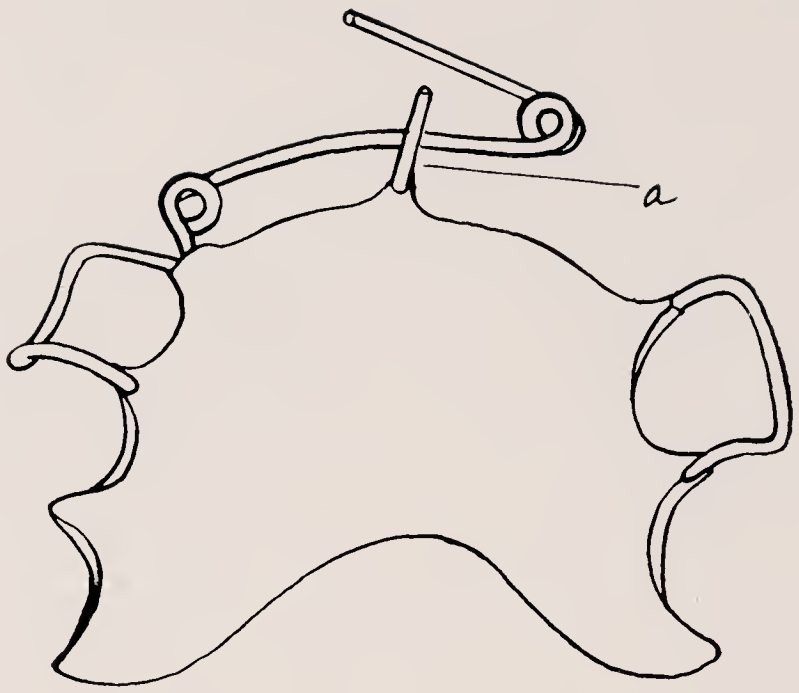


FIG. 14. Use of spring protection on removable plate. The strut "a" prevents displacement of the spring. The protective methods illustrated in Figs. 9 to 13 can be applied to plates also.

Other knowledge which has to be taken into account in designing the framework is :—

(*a*) The requirements of the peridental membrane. The necessity for freedom of teeth to yield under shock limits the rigidity of framework and attachment to the teeth.

(*b*) Mouth function as it affects location of the framework.

It necessarily follows from the important part played by the framework that the completion of each stage of the treatment calls for a review of the design of the appliance. When new sources of pressure are to be brought into action, not only will the direction and amount of reactions have to be re-estimated and proper resistance provided for, but adequate protection for the new sources of pressure must be ensured. This will frequently call for a reconstruction of the functional parts of the appliance.

I have covered the general outline of designing the essential parts of appliances as I think it should be taught. There remain non-essential, but of course sometimes important, points such as convenience of operation. That dictates a degree of removability which will vary with the frequency of adjustment or alteration which the appliance will require. Familiarity with the various locks and clasps which are available will enable the student to choose a suitable form of attachment. I do not deal with the subject because I wish to emphasise the fact that these things are conveniences which do not directly affect the achievement of the appliances' object.

It may appear that the plan I have been advocating does not apply to what will perhaps best be visualised as "Ribbon Arch" appliances. There seems to be an idea at large that E. H. Angle designed a range of "appliances" which have only to be inserted in the mouth. Actually the feature common to all the individual appliances that carry a type name of that sort is that they are made from materials that have been given a special form before they

reach the operator. The limitations imposed by the form of the materials on the actual design give a superficial appearance of uniformity, but in fact each appliance must be an individual design for which the operator is alone responsible.

The most important limitation which the materials impose arises from the fact that the form of the materials is based on the assumption that source of pressure and framework are to be combined in one, except where intermaxillary traction is used. What I said earlier indicates that the requirements of these parts are so widely different that a good framework will seldom make a good source of pressure and vice versa, but it is possible to combine their functions in one piece of metal, and that piece of metal has to be designed to give the best compromise between the requirements of the two purposes for the case in hand.

While I believe that the plan of designing I have outlined can be used for appliances of ribbon arch or edgewise arch materials, I do not wish it to be assumed that I am in sympathy with the view of orthodontia that seem to me to inspire devotees of this type. The outstanding feature of the type is absolute control. That is a state of things one may well wish to impose on individual teeth that show a clear departure from the general line and inclination, or even on whole dentitions for a short time and at an advanced stage of development. But it is a state which, applied to the dentition as a whole, implies that the operator is prepared to dictate to the dentition what form it shall take in every respect, without regard to the possible temporary or permanent incapacity of the individual to conform to an ideal. The operator relinquishes the help he can get from the teeth themselves in that they can neither take advantage of improved conditions created in the course of treatment nor demonstrate the tendencies of the individual.

Where in the course of this paper I have set out in detail items from the knowledge used in designing, I have made such a selection as would illustrate the general lines on which I personally think the outstanding difficulty in mechanical treatment should be met. All appliances are compromises between conflicting requirements, but the main conflict is between a need for considerable range of movement without adjustment and a need for reliability. Sources of pressure having a small range of action, contractile ligatures and stiff springs, are from their nature reliable, but they involve a frequency of adjustment which puts extensive orthodontic treatment out of the reach of very large sections of those needing it. It is on the lines I have indicated that I think the same reliability can be achieved without the frequency of adjustment which these sources of pressure require.

But I do not want to leave you with the idea that appliances on these general lines should have any monopoly. Where the right method of designing is followed, it is the characteristics of the actual case which dictate the form of the appliance, so that a case, for instance, which had as its main requirement the rotation of incisors, would call up in the designer's mind in some respects a different range of knowledge. Probably the dominant considerations would be the inclinations of most of the incisor surfaces to the plane in which movement is to take place, which make

difficulty in obtaining and maintaining correct direction of pressure for rotation ; and secondly, the acute change of direction of a short single spring, which fits in well with the acute change in direction involved in rotation. So that the design may well work out on the lines of positive attachment of short thin springs to each of the teeth to be rotated.

I am told by one who has read this paper that I have made a simple subject appear complicated. I am conscious of the apparent complication of the treatment, but I am not so sure of the real simplicity of the subject. You who design appliances do not always realise how complex are the mental processes through which you go in evolving your design, and it must be remembered that in actual teaching these verbal accounts of spring behaviour, against which I think the charge of complication is mainly levelled, would be accompanied by demonstration, a much more illuminating process than illustration.

In conclusion, I would like to thank Professor Walmsley of the School of Medicine, and Professor Hummel, School of Engineering, Queen's University of Belfast, for the great assistance they have given me over a long period in reaching an understanding of the subjects I have dealt with in this paper.

Summary.

(Summary of the author's views on the teaching of the mechanical side of orthodontic treatment, parts of which are developed in this paper.)

As equipment for designing appliances students should be taught :—

(*a*) The nature and behaviour of tissues and the functional action of the organs of the masticatory face as they affect design.

(*b*) The nature and behaviour of materials available for use in appliances.

(*c*) The nature and behaviour of all sources of pressure used in appliances.

(*d*) Some elementary mechanics, such as the theory of levers, inclined planes and resultant of forces.

Of these, (*a*) and (*b*) are already taught, but might be much more closely related to the actual problems of design.

Students should then be taught to set about the designing of each appliance on a definite plan, using the knowledge indicated above to build up the design best suited to the particular features of the case.

As an aid to the translation of theory into practice, a wide range of appliances should be demonstrated, and the features which fit them for their particular tasks explained.

The plan outlined in the paper for the building up of a design is as follows :—

(1) Teeth are divided into groups, each of which is to be moved by a single source of pressure. The main characteristic of a group is similarity of direction of movement.

(2) The reactions set up in the application of pressure to these groups are estimated, and a resistance group provided which shall have a clear margin over any unbalanced reactions.

(3) A source of pressure is chosen for each tooth or group of teeth, the characteristics of which fit it to give the required pressure, direction and range of action.

(1, 2 and 3 interact on one another so that considerations involved in 2 or 3 may call for review of 1 or 2.)

(4) The general lines of a framework are designed to distribute the actions and reactions of the sources of pressure to movement and resistance groups.

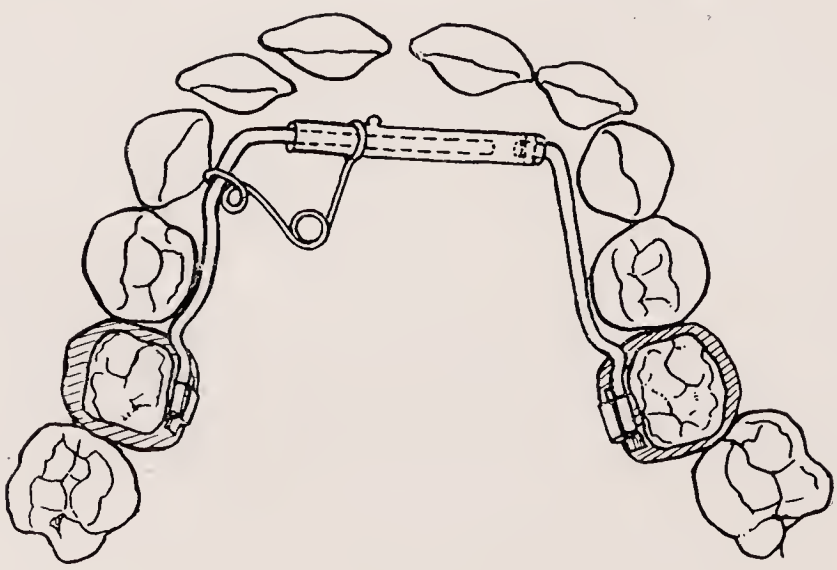
(5) Provision is made in the detailed design of the framework for protection of delicate sources of pressure and avoidance of conditions injurious to the tissues.

(6) Provision is made, if not already included under 4, for attachment of the appliance, and means of detachment in part are arranged if necessary.

Discussion.

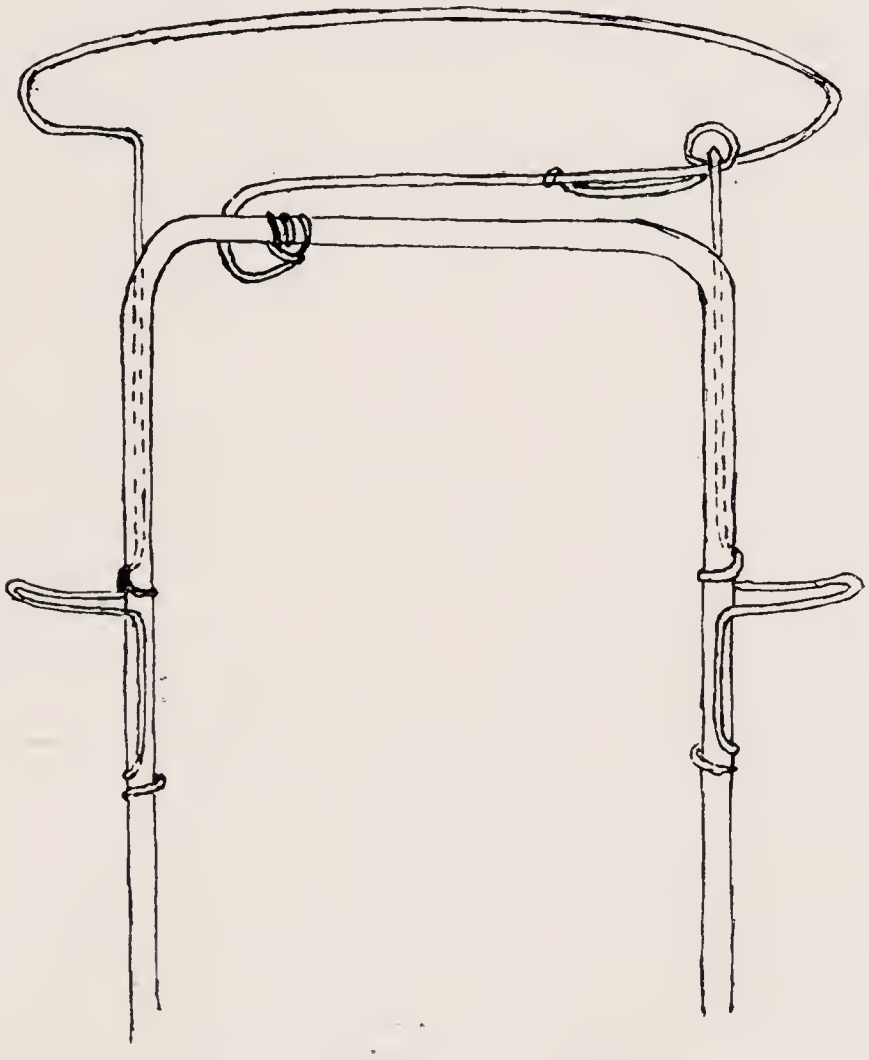
Dr. Sheldon Friel said the fact that he had already discussed the paper many times with the author was not altogether an advantage in his opening the discussion, as Mr. McKeag had an answer for any criticisms he had to make. Mr. McKeag laid great stress on the paper being suitable for teachers, but personally he thought it applied equally to all practitioners in orthodontics, because it was of the greatest importance to have a logical plan in designing an appliance. He was not quite in agreement with Mr. McKeag as to what should be taught to students. If Mr. McKeag's scheme of teaching design was adopted, he was afraid it would take up a great deal of time in the short orthodontic course, with the result that some other work, which personally he considered of greater importance, would be neglected. He thought the only solution was to divide the orthodontic course into two parts, a compulsory course and a voluntary course. The compulsory course would comprise dental anatomy from an orthodontic point of view, ætiology and diagnosis, and clinical experience in those subjects, so that every dental surgeon would be in a position to recognise disease in its early stage. He thought that was the trend of medical education at the present time, i.e. to make every medical man capable of recognising disease in its early stage and not to make him a specialist in every subject. In dental schools there were students who had a special aptitude for orthodontics or some other subject, and he thought they should be given an opportunity of learning more of the subject for which they had a special aptitude. Therefore he thought there should be a voluntary course in orthodontics which would deal with the design of appliances and the reaction of the tissues to appliances and which would also comprise a certain amount of clinical work, but he did not think that such a course would be suitable for every dental student. It must be remembered that in teaching, one had to come down to a fairly low average, and a good deal of time was wasted in teaching students with mediocre brains. He thought it had been the custom amongst orthodontists, when designing an appliance, to make a lingual arch or a buccal arch and then design the spring afterwards and try to make it adapt itself to the framework, but Mr. McKeag's method was much more logical, i.e. to design the source of pressure first and then to make the framework. He thought a great many troubles would have been prevented if that method had been generally adopted by orthodontists. The design of the framework, he thought, was of the greatest importance in supporting the source of pressure and in distributing its reaction, and also in the protection and direction

of the source of pressure. Sometimes cases occurred in which the framework had to be designed first. He had had a rather unusual case in the previous week, in which he had had to design the framework first. The patient was a child of 8 years of age who had a narrow upper and lower arch, but the narrowness was equal between the intercanine region and the inter-second deciduous molar region. It was a general narrowing, not a V-shaped arch. The first permanent molars were only just erupting, but the incisors had all erupted. Therefore the first permanent molars could not be used for the attachment of the framework, and the second deciduous molars had to be used for making the attachment, and they also had to be moved, so that he had to use the framework to distribute the pressure. He made a McKeag's attachment to the deciduous molars and used a 1 mm. arch, touching | e d c, bringing it as far as the medial surface of | c. On the other side he made a similar attachment but used a .9 mm. arch, which was slightly thinner, and he brought it forward as far as the medial surface of c | and then it bent at right angles towards the end of the other half of the arch. To the end of the 1 mm. arch he welded a tube that went across to nearly the opposite canine. The .9 mm. half of the arch worked freely in this tube. It was now necessary to find a source of pressure to separate the two halves of the arch. It consisted of a .3 mm. spring welded to the .9 mm. arch and acting against a stop on the long tube. He then had a means of separating the two halves. He had shown the case to illustrate that first the framework had had to be designed and not the source of pressure. Some months ago Dr. Schwarz had read a paper on stainless steel appliances, and, when thinking about what Dr. Schwarz had said, he considered that the thinner springs were better than the thick springs that Dr. Schwarz used. Dr. Schwarz used .6 mm. wire, whereas he himself used .35 mm. wire, because there was such a small range of movement in a thick spring wire and frequent adjustments had to be made. The advantage Dr. Schwarz had in using the thicker wire was that the spring was strong and was not deformed by mastication, and, in replying to the discussion on his paper, Dr. Schwarz gave a very apt illustration : he pulled out his watch and said : " This contains a very delicate mechanism, but it is covered by a case ; in the mouth you have not got a case to cover your delicate mechanism." Personally he thought Dr. Schwarz was wrong in that ; he thought a case was provided for the springs if the free ends of the springs were wrapped round the arch, and also the springs were protected during mastication as they lay between the arch and the gum. There has recently been a certain amount of controversy in orthodontic journals as to whether continuous or discontinuous pressure was the most desirable. There was no such thing as a continuous pressure, and the evidence brought



forward by the different people was very conflicting, partly because their experiments were so very different. He himself had no evidence to give except his own clinical experience, which showed that when a weak pressure was used for a long period, avery much better movement of the teeth was obtained than when a strong pressure was used for a short time. He had tried many fixed appliances. He started with buccal arches and ligatures, then pin and tube appliances and ribbon arches, all very painful things. Then he used the Mershon lingual appliance with fairly thick springs, and lastly lingual arches with very thin springs, which did not give the children any pain and did not cause tilting of the teeth. He thought, from clinical experience, that continuous or semi-continuous action of springs was very much more satisfactory than discontinuous action. Mr. McKeag's paper was most valuable, his method being quite unique, and he thanked him very much indeed.

Mr. H. G. Watkin said he agreed with all that Mr. McKeag had said and therefore had not any criticism to offer. Referring to Dr. Friel's remarks, he thought there was no question about it that a weak spring, acting for a long time and requiring practically no adjustments from beginning to end, was infinitely better than a strong spring that had to be frequently adjusted or the old ligatures which had now gone out of use. The sketch showed Dr. Friel's original wire with additions. It frequently happened that the deciduous second molar had been lost early and the second premolar could not erupt. It was then necessary to move forward the teeth anterior to the second premolar.



Mr. Hubert C. Visick said that he felt he must have put all sorts of queer pressures on teeth, not knowing at all what he was doing, but he thought that in the course of years one learned to bend a wire a certain distance and get a certain result. If one tooth required 24 grammes pressure to move it, how did Mr. McKeag increase the pressure to move a greater number of teeth? Did he use varying thicknesses of finger-springs, and had he any apparatus for testing the amount of pressure he was applying? Mr. McKeag had given the pressure required to move the crown of a tooth, but if one had a central incisor whose roots needed moving, it seemed a most difficult thing to calculate the amount of pressure that was required. How did Mr. McKeag calculate it?

Miss K. C. Smyth said she did not feel capable of discussing the paper from a technical point of view, but she would like to express her appreciation of it from a totally different point of view, namely, that it encouraged teachers of orthodontics to put their thoughts into words. She did not see how a student could possibly learn to do the kind of things which Mr. McKeag had described that evening unless he had trained himself to read and to take in what he read.

Mr. H. T. A. McKeag, in replying to the discussion, said that Dr. Friel wished to reduce the amount of orthodontics that was taught to all dental students, and he quite agreed that that should be done. Until it was done, he thought all one could aim at was to cover a little ground as well as possible, and one should not try to cover the whole of orthodontics in an undergraduate course; that was quite impossible and only led to tinkerers.

With regard to designing first the source of pressure and then the framework, he did not think he had made it clear in the course of his paper that the process one went through in designing was a see-saw one, from source of pressure to framework and back again to source of pressure. One designed sources of pressure and rejected them because they did not fit in or did not lend themselves to protection by a framework or for some other reason, and then one went over the ground again and designed a new source of pressure and saw how that would fit into the scheme. Therefore, while he had tried to trace the process of designing, he did not claim that it was a matter of designing a source of pressure complete in itself and then designing a framework.

With reference to the appliance which Dr. Friel illustrated, Dr. Friel seemed to think that in a particular case he had designed his framework first and then his source of pressure. Personally he did not agree that that was the case; he was quite certain that Dr. Friel had a mental picture of a source of pressure and proceeded to see how a framework could be made to distribute its action and reaction, and that was how his design actually evolved. That brought home to him what he had said before, that the people who best knew how to operate appliances, very often did not recognise the mental processes that they went through in designing their appliances.

With regard to the subject of continuous and discontinuous pressures, he had gone into that question and had been very much inclined to deal with it in his paper, but he had come to the conclusion that on theoretical grounds no conclusion as to the advantages of continuous or discontinuous pressure was possible at present. On the whole he thought that the evidence from histology and so on, favoured the use of continuous pressure; but even if the evidence seemed to be going the other way and favouring discontinuous pressure, he would not be in the least worried: he would go on trying to use continuous pressure, because it was quite obvious that bone was a very accommodating thing, and he had found that continuous pressure worked so well, that he would require enormously strong laboratory evidence before he would change his view on the subject. He thought the motto might be adopted: "Take care of the peridental membrane and the bone will take care of itself."

He did not agree with Dr. Friel that the method of designing outlined in the paper was unique. It was as near as he could get to a mental process that every good orthodontist went through in designing appliances, and what he had tried to do was simply to put into words that mental process for the benefit of the rising generation of orthodontists, in order to pass on what had been learned by experience.

He very much liked Mr. Watkin's method of testing springs. He himself tested springs occasionally as a matter of interest. He thought if one used a fairly small range of materials, one got to know roughly what sort of pressure one was using, and it need be only a very rough knowledge. That connected up with what Mr. Visick had said about the necessity for getting 24 grammes pressure on each tooth. Mr. Visick referred to Mr. Watkin's illustration, where springs were working on eight teeth, and said he did not see how one could get 24 grammes pressure on each of the eight teeth. Actually the figure given by Dr. Schwarz as a maximum, which he had quoted in his paper, was 20 grammes per single tooth. The maximum pressure, which was the only thing that one need worry about much, was the pressure that the peridental membrane or the blood vessels in the peridental membrane would stand without the blood supply being cut off. He used to think that there was not any minimum pressure, but he had found, when using the very lightest springs, on a number of teeth together, he had reached the minimum; he could not measure what that minimum was, and for single-root teeth it was very, very low. One seemed to need a larger pressure to start movement than to carry it on. On the other hand, one met cases now and again where the theoretical maximum pressure, i.e. 15 to 20 grammes per square centimetre of root area, would not produce movement, so that the minimum pressure necessary to produce movement was greater than the permissible maximum. In such cases he sometimes increased the pressure and that did not seem to do any harm, but it did not do any good, because the teeth always went back. As he had tried to bring out in his paper, the pressures that were acting on the teeth were not necessarily all acting on the blood vessels in the peridental membrane, because they were cancelled out by opposing pressures from lips very often.

Mr. Visick had asked about the pressure necessary to produce root movement without movement of the crown. He did not think there was any reason to believe that the pressure in that case should be any different from the pressure used in any other circumstances. There was a statement frequently made in textbooks that a greater pressure was required to move teeth bodily than to move them in a tilting fashion, but that was a mistake. It took exactly the same pressure to produce bone action whether one was moving the tooth bodily or moving it by tilting. The reason for the wrong impression being created was that pressure was usually applied to teeth at the end of a lever, i.e. one did not apply pressure opposite the centre of resistance, and when one tried to move teeth bodily one applied the pressure to the crown in such a way that part of the pressure was really working in the opposite direction to prevent the tilting of the teeth, so that the actual net pressure on the teeth was not nearly so great as the gross pressure that was being applied. (Fig. 15.)

Miss Smyth was mainly concerned about the teaching of orthodontics, and he had been very glad to hear her remarks, because his concern in the paper was primarily for teaching. The method he had tried to describe that evening had suffered from the fact that he could not accompany it with demonstrations. In teaching it was demonstration combined with a clear explanation that was important. In that connection he thought it would be useful at one of the demonstration meetings to go through the process of design, designing a particular

appliance and explaining why each step was taken. He did not propose to do that, but he had been trying to make arrangements for it to be done at a demonstration meeting in the near future.

On the proposition of the PRESIDENT, a very hearty vote of thanks was accorded to Mr. H. T. A. McKeag for his paper, and the meeting then terminated.

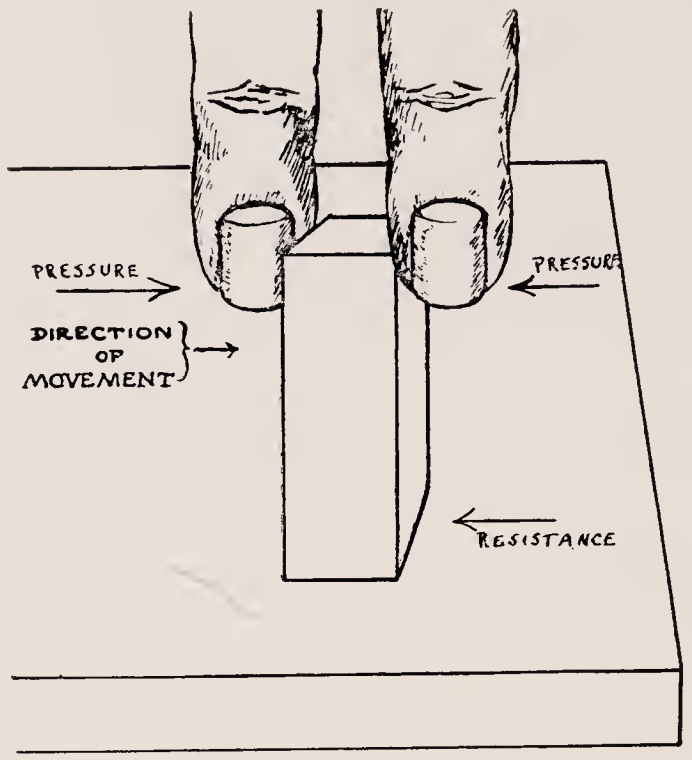


FIG. 15. Illustrating the analogy between bodily tooth movement by pressure applied to the crown, and movement of a match-box on end along a table. To prevent tipping of the box some pressure must be applied in the direction opposite to that in which movement is desired. The pressure overcoming the resistance (friction between box and table) is the difference between the pressure of the two fingers.

PRENORMAL OCCLUSION TRUE AND APPARENT.*

WITH A NOTE ON THE ÆTIOLOGY AND PROGNOSIS OF THE CONDITION.

By R. O. BARBER, L.D.S.Eng.

THE literature of this subject, prenormal occlusion, is scant and scarcely illuminating, both as regards the two types that occur and the treatment of these types, which though similar in appearance, are totally dissimilar in their ætiology and prognosis. Prenormal occlusion may be defined as a state of the teeth and jaws in which the inferior dental arch is anterior to its normal position of occlusion with the superior dental arch. Such prenormality may be in the molars and anterior teeth or in the anterior teeth alone.

"True" prenormality, therefore, is reserved for those cases in which all teeth in the lower jaw are anterior to their normal position, and has the following characteristics :—

(1) A normally developed maxilla with an abnormally developed mandible.
(2) Prenormal occlusion of the inferior molars with the superior molars (this factor is not constant).
(3) Labial occlusion of the inferior incisors.

In "apparent" prenormality we find :—

(1) A normally developed lower jaw with a maxilla shortened in its antero-posterior depth.
(2) The molars in normal occlusion.
(3) Labial or edge-to-edge occlusion of the mandibular incisors.

This term is reserved for those cases which have the appearance of being of Class III (Angle) type—but fall short of the definition in molar occlusion, and will also include superior retrusion. The ætiology of the two conditions is somewhat different. Whereas true prenormal occlusion is a matter of definite overgrowth of the mandible, apparent prenormal occlusion is due for the most part to trauma.

True prenormality is due to interstitial growth of the mandible —such growth may be within the tooth-bearing area or posterior to it at the angle. It is considered by some authorities to be due to a familial trait : the anthropologists would have us believe it is due to the admixture of races that has caused the irregularity and is therefore hereditary. The embryologists say it is due to the rapid and unchecked growth of the mandible which occurs *in utero* at the tenth week, during the fifth to sixth month, and about the third month after birth. The pathologists believe it is due to some hyperplasia, and the endocrinologists to some endocrine dystrophy. That any one of these contributory and predisposing factors can alone be responsible is unproven, but that they might be all involved is highly probable.

Apparent prenormality, on the other hand, is due to the assumption of a forward biting position—brought about by various factors to be noted later—maintained by Nature's retention apparatus, the interdigitation of cusps, resulting in undue pressure on the developing maxilla and its subsequent retardation of growth.

* Read before the British Society for the Study of Orthodontics, Nov., 1935.

The premature extraction of deciduous lower molars, subsequent collapse of the bite and assumed occlusion of the lower incisors labial to the upper incisors ; and the retention of deciduous upper incisors, causing the permanent incisors to erupt palatally and therefore posterior to the lower incisors, are undoubtedly prime factors in causation.

Habits such as thrusting forward of the chin and arching of the fingers over the lower incisors, may be acquired early in life and persist, for it is the natural position for the lower jaw in suckling. These factors do undoubtedly cause apparent as opposed to true prenormality, as can be seen from the maxilla, which in such cases is underdeveloped.

The diagnosis of these two conditions is important, inasmuch that the treatment and prognosis are so dissimilar. True prenormality is exemplified by the open angle of the mandible ; the apparent sinking-in of the upper lip—accentuated by the pouting lower lip ; the prominent mental process as seen in profile ; and often a strong family history. Apparent prenormality shows none of these points. The profile is normal, the mental prominence not marked, the lips are not pouting, and the angle of the jaws is normal.

We have one further aid to diagnosis which, though interesting and of undoubted value, must not in any way be allowed to supplant the most important method, clinical observation, and that is skiagram records, as used by Drs. Brustin and Leitz, who showed that in the true types there was no gap between the last erupted molar and the one immediately posterior to it, whereas in the apparent type there was a space.

The prognosis of these types depends upon the correct diagnosis and response to treatment. In a case of true prenormality one can only hope to suppress any further excessive growth. On no account must the maxilla be stimulated in its growth, or extraction done in the mandible or the end result will be more truly alarming than the original position.

Apparent pronormality has a very hopeful outlook. Providing it is realised that the maxilla is at fault, all that is required is the promotion of bone growth in the anterior direction and the condition shortly becomes self-retentive.

I have to thank Mr. Bocquet Bull for his kindness in allowing me to publish the following cases :—

Case 1.—True prenormal occlusion type. 6 years 2 months.

Fig. 1. Shows open angle of jaw, pouting lower lip and sinking-in of upper lip.

Fig. 2. Shows prenormal occlusion in the models—the prenormality of the lower incisors is even more marked.

Fig. 3. X-rays of same, showing no space between last erupted tooth and the one immediately posterior.

Case 2.—True type. 6 years 9 months.

Fig. 4. Shows normal profile and features, but an open angle of the mandible.

Fig. 5. This is interesting, inasmuch as the spacing is apparently confined to the front of the jaws.

Fig. 6. Palatal view of same, showing abnormal development of anterior portion of mandible.

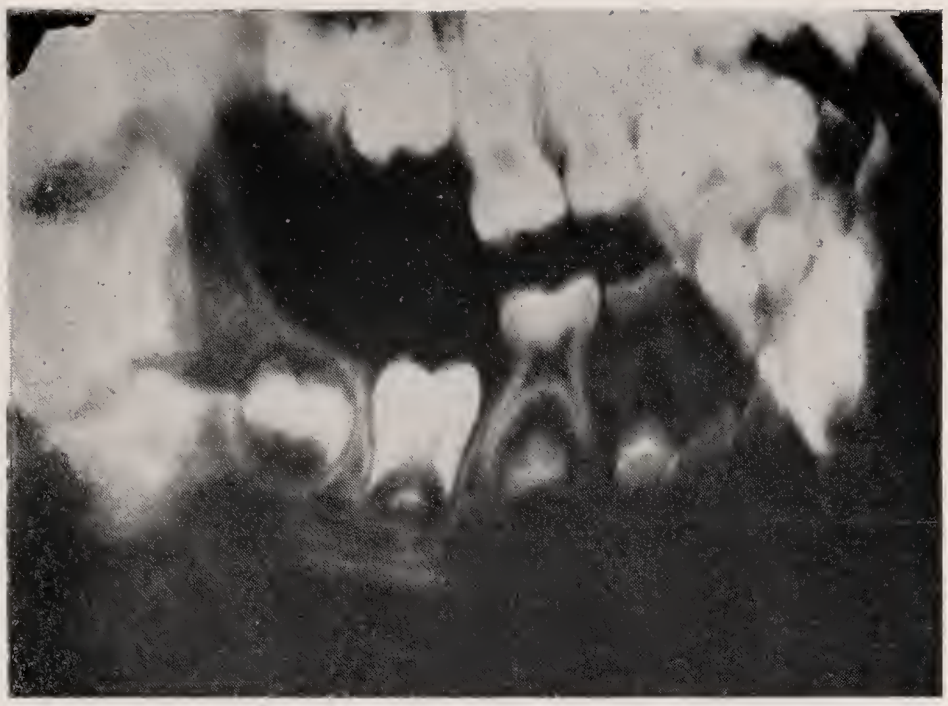


Fig. 7. X-rays of same—"no spacing"; therefore, according to Brustin and Leitz, a true type.

Case 3.—Apparent type. 6 years 1 month.

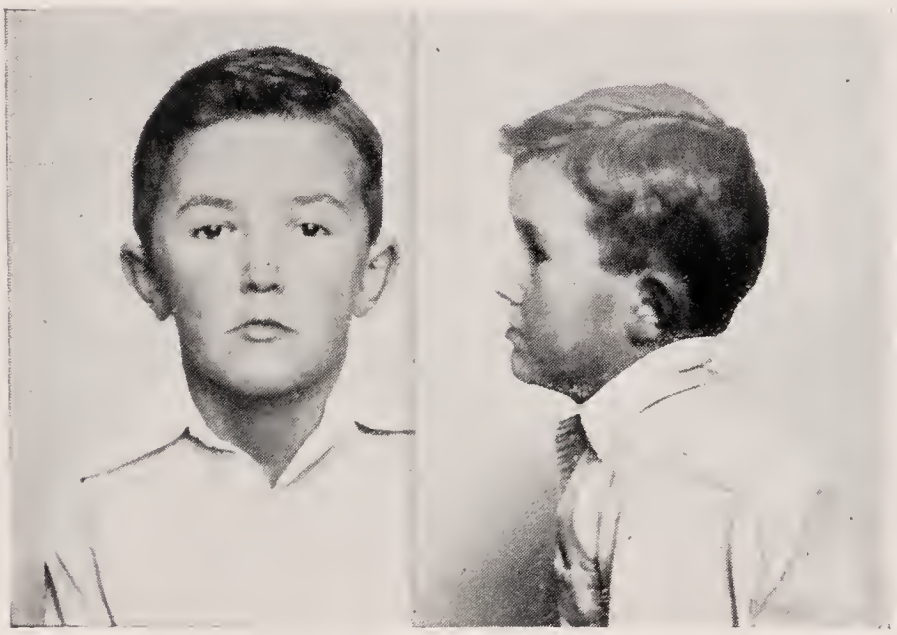


Fig. 8. Shows an abnormal profile with all features of true type.

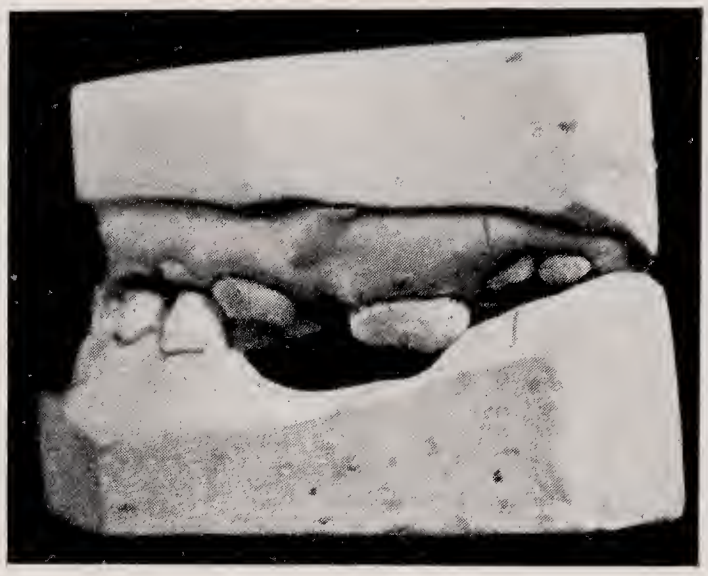


Fig. 9. Models show extensive collapse of bite—subsequent to extractions of deciduous molars at the age of 2 years 9 months. Marked attrition of all deciduous incisors.

Fig. 10. X-rays showing a space between $\overline{|\ 6\ 7}$ which, together with history, prove this to be of the apparent variety.

Discussion.

The President said that Mr. Barber had brought forward a very interesting short Communication, and invited those present to discuss it.

Dr. George Northcroft said that, without wishing to detract in any way from Mr. Barber's Communication, he would like to point out the necessity of trying to be as uniform as possible in the nomenclature used. The idea of insterstitial growth of the mandible had been generally abandoned.

Mr. H. G. Watkin, referring to the spacing of the front teeth which had been shown by Mr. Barber, said he thought it was probably due to an abnormal method of swallowing. He had been surprised at the large number of cases he had seen recently which had been due to the patient never having learned to swallow properly. The patient when swallowing pushed out his tongue between his teeth. The exercises to correct that abnormal method of swallowing were very easy, and by regular use the defect could be cured in about a fortnight.

Mr. A. T. Pitts said that Mr. Barber had brought forward a very provocative short Communication which dealt with an important subject. There was a good deal of interesting matter in it, but he was rather at variance with some of the statements made. He found it somewhat difficult to follow Mr. Barber's distinction between apparent and true prenormal occlusion, particularly in the cases that Mr. Barber had shown. Personally he considered the molar relationship as the keynote in indicating whether there was a true inferior protrusion or whether the case was one mainly of a maxillary retrusion. He rather doubted Mr. Barber's statement that in the true cases the mandible only was affected ; possibly that might be so in the very early years of life but he was sure that it soon ceased to be so. Just as in cases of postnormal occlusion one invariably found associated with it either maxillary protrusion or maxillary retrusion, according to whether it was a Class II, Division I, or a Class II, Division II case, so in cases of inferior protrusion one nearly always found associated with it some degree of maxillary retrusion, particularly when one saw the case with the permanent teeth present. There was no doubt that, if one wanted to learn anything about inferior protrusion, one must see children in the very early years of life, when the condition was present in the deciduous dentition. He had watched children in the early years of life for a good many years and had found that a considerable number of children showed an edge-to-edge bite which he felt quite sure would become true cases of inferior protrusion in later life, and in some instances he had been able to satisfy himself that that had happened. If one found a true (as distinct from a functional) edge-to-edge bite in a child with deciduous dentition, one might be fairly sure that that child would show an inferior protrusion later on. Of all forms of irregularity the one which he thought tended most to be progressive if unchecked, was inferior protrusion, and he could not agree with Mr. Barber's statements on the question of treatment. He did not think there was anything like enough evidence to justify one in saying that treatment should not be carried out. With regard to the possibility of there being some endocrine disturbance in cases which appeared to be progressive, if Mr. Barber would consult the *Transactions* of the Second International Orthodontic Congress, he would see a lengthy paper by G. Korkhaus*, who took radiographs which failed to show any evidence of alteration of the sella turcica. There were some cases which defeated all efforts at treatment and which went on steadily progressing, but he did not believe that was so in the majority of cases. Of all forms of irregularity he thought the one that most justified treatment while the deciduous dentition was in place was definitely a true case of inferior protrusion. When he

* *Transactions* of Second International Orthodontic Congress, 1931, p. 341.

delivered his presidential address before the Society, one of the models that he showed was that of a child about five years of age who had a most clearly marked inferior protrusion, with a very deep overlap of the lower incisors over the upper. In that case the lower molars were also in a labial occlusion to the upper molars. He started treatment while the deciduous teeth were functioning, just previous to the shedding of the upper incisor teeth. Of course the result was (as Mr. Barber had said it would be in such cases) that the whole condition was made much worse, for the time being. As he guided the permanent upper incisors into a labial position to the lower incisors they tilted forwards and became widely spaced. The æsthetic result for some two years or so was infinitely worse, but now, some years later, the condition was steadily improving. He had tried pushing back the lower incisors, but he thought he might have saved himself the trouble. The pressure of the upper incisors was pushing back the lower incisors, while the pressure of the lip was bringing the upper incisors together, aided by the further development of the canines. He had not the slightest doubt that when the child was about twelve years of age she would have an extremely good upper arch, produced quite naturally when once the upper incisors had been brought outside the lower; it seemed to him that that was absolutely essential. With regard to extracting teeth in the lower jaw, he would certainly have no hesitation whatever in doing so if extraction seemed to be the best way of making the lower arch smaller. He did not think there was any evidence to suggest that if teeth were taken out in the lower jaw the result would be an increased bone growth. Although he doubted very much the correctness of Mr. Barber's views with regard to treatment, none the less he was very grateful to him for showing such interesting cases and for the very interesting Communication that he had brought forward. In reply to a question as to what was the age of the children who had edge-to-edge occlusion of the deciduous incisors, Mr. Pitts said it was four or five years.

Mr. Harold Chapman said he had listened with great interest to Mr. Barber's Communication. The first slide that Mr. Barber had shown seemed to him to emphasise the necessity of knowing what was normal before one could diagnose the abnormal. From the slide it was difficult to say what the condition was, though he strongly suspected that it was one of prenormal relation of the lower arch to the upper. He based that diagnosis on the relation of the lower canine to the upper rather than on the relation of the molars. The lower canine, in his opinion, was definitely more medial in relation to the upper teeth than it should be at the age in question. There was a difficulty in relying on the molars for diagnosis, because in the temporary dentition there were teeth and spaces, and in such a case as that shown it was possible for some of the spaces to close up abnormally on account of the interdigitation of the cusps. In other words, if there were no spaces in the upper jaw it might be assumed that the upper molars had moved forward in order to interdigitate correctly with the upper teeth, and, if that were so, it would then make the molar occlusion appear to be correct. He thought the Museum of the Society could be made very valuable if it had series of models showing normal occlusion. There was another point in regard to the cases in question, and the way he was trying to put it to students now was this: one might have perfectly good arches and prenormal occlusion of the lower arch in relation to the upper one, the arches being the correct size except in so far as they were varied by the lower front teeth being labial to the upper ones. In addition to that abnormality one might have what he would call a Class I case imposed upon it, i.e. a case in which the masticatory face or apical base was too small—the arches were too small and the teeth were not spaced or were crowded. He thought one must be prepared to expect crowding in both the upper and lower arches in a certain number of such cases. He was not quite clear what Mr. Barber said in regard

to extraction. His experience was that if the lower arch was a good one, it did not avail anything to remove the lower teeth. The way he explained that to himself was that those teeth were set on an arch (visualising the mandible resting on the distal border of the ascending ramus) and there was no place into which they could be pushed back ; they could only be moved round the arch, which in a well developed arch meant creating spaces or be made to incline lingually. Personally he had found in practice that the better treatment was to retract the mandible. In one case where the two first lower premolars had been removed at about 14 years of age he found that one only got the sloping back of the teeth—the position of the mandible was not changed though intermaxillary traction was used. In his opinion the movement back of the mandible was essential if a good result were to be obtained.

Mr. Robert Cutler said that thanks were due to Mr. Barber for his very excellent Communication. He thought that Mr. Barber had quite clearly in his mind the essential distinction between the true Class III case (inferior protrusion) and those cases with a normal lower jaw and an undeveloped upper one, which Mr. Pitts described as " superior retrusion." Personally he did not profess to know anything about nomenclature, but he considered that the term " superior retrusion " was quite inappropriate, because it indicated a pulling back of the upper jaw, which did not occur ; it was a case of lack of normal forward growth. As Mr. Pitts had said, there were many cases in which it was very difficult to make up one's mind whether they were true Class III cases or what he would call Class I, Division III, cases, and it was quite true that in some cases in which there seemed to be overgrowth in the lower jaw there was a lack of growth in the upper jaw as well. None the less, there were two clearly defined groups of cases : overgrowth of the lower jaw, on the one hand, and, on the other hand, a more or less normal lower jaw associated with an upper jaw which seemed to have failed to grow normally antero-posteriorly, so that one got the characteristic relationship of the anterior teeth. The distinction was most important, because the prognosis varied. The so-called Class I, Division III, or the apparent prenormal, cases invariably did amazingly well under treatment, whereas the response of Class III cases to treatment was not so good. He believed Mr. Barber said that he was against extraction in true Class III cases, and he thought Mr. Barber was visualising those true Class III cases in which the six-year molars had been removed and the whole bite had completely closed together, so that any orthodontic intervention was well-nigh valueless. With regard to the differential diagnosis between the true Class III cases and the apparently prenormal cases, it was useful to compare the plaster models with the facial appearance. One might have plaster models of a child of six, seven or eight years, and the appearance of the models might be bad, but when one looked at the patient one saw that the general facial ensemble was remarkably good. Further examination of such a case usually showed that it was apparently prenormal, i.e. what he called Class I, Division III. On the other hand, one might have a pair of plaster models which did not look too bad, but when one looked at the patient one saw the open angle, and so on, and from that and other points of differential diagnosis one put the case in Class III, with a bad prognosis. Over a year ago, Mrs. Lindsay had made a most valuable contribution to the subject by X-ray examination, and since then he had taken lateral views of all the cases he had seen. So far he could not say that he had had great success in seeing how they confirmed what he knew clinically. The X-ray appearance should really only confirm one's clinical knowledge.

Mrs. Lindsay asked Mr. Barber if there was any respiratory obstruction in the cases he had shown that had a distinctly rounded angle. C. Breitner had brought forward the point that very often narrowness in the maxillary region and a respiratory obstruction caused a child to push forward its lower jaw and so remould the angle.

Mr. C. L. ENDICOTT, referring to the cases shown by Mr. Barber which Mr. Watkin considered as being due to an abnormal method of swallowing, said that about six weeks ago he saw a patient of 22 or 23 years of age who had precisely the condition in question, in the molar dentition. It would be interesting to hear an explanation from Mr. Watkin with regard to the mandible moving forward when deciduous molars had been lost. He believed Mr. Bull had had some cases of that kind.

Mr. F. B. BULL said he had had a case some time ago in which all the deciduous teeth, except the lower six anteriors, had been extracted at a very early age, and the mandible seemed to come forward very markedly in that case. It might be said that there was not a protrusion prior to the extraction of the teeth, but there was still a very marked tendency to protrude, and he thought it was quite possible that if the teeth had not been extracted the protrusion might have existed.

Mrs. MICHAELIS said that she had found that if a real Class III case were treated sufficiently early, at five years of age, it responded quite well to the method which Mr. Chapman had mentioned.

Mr. RUSSELL MARSH said he had noticed that no speaker had called attention to the X-ray photographs shown by Mr. Barber ; he had been waiting for someone to do so. With regard to the question of the six year old molar being in close contact with the root of the temporary molar tooth, he thought he was right in saying that, in the only cases shown in which there was a space, the space was between the unerupted six year old molar and the second premolar, and it appeared to him that if the temporary tooth had been present in those cases the root would have been in approximation to the six year old molar. In other words, the space was no more than would accommodate the temporary tooth. He had been interested to hear Mr. Watkin's few words about the spacing of the anterior teeth. He had always been under the impression that such cases were due to an abnormally large tongue, but Mr. Watkin seemed to think that a normal tongue with an abnormal swallowing motion would have the same effect. He had once had the sad experience of attempting to treat a child of about twelve years of age who had undue spacing between all the anterior teeth in the upper and the lower jaw. The treatment was not completed, as the child went away after about six months, but towards the end of that time he discovered that he was up against an impossible case, because when the appliance was removed the teeth relapsed immediately, the cause being an abnormally large tongue. Mr. Barber had shown one case on the screen in which the temporary teeth had been lost, but it struck him that that was quite a good reason for the production of a false impression of Class III dentition. The jaws of all edentulous people came into something approaching contact and they appeared to have prominent chins, like Mr. Punch, the reason being that the new angle of the lower jaw, in its close approximation to the upper jaw, must come further forward. It struck him that, if a child was edentulous at the back of the mouth, at any rate, the lower jaw would tend to slide forward in closing up in the extreme close-bite, and that, as the permanent teeth developed, that assumed position might be continued and might develop into what might be taken for a true Class III case.

Mr. F. B. BULL said he had been rather struck by the remarks of Mr. Russell Marsh. He thought it was common knowledge that the early loss of temporary teeth frequently caused the lower jaw to protrude. He had seen dozens of such cases every year, and he was surprised to hear it spoken of as a rare condition.

Mr. R. O. BARBER, in replying to the discussion, thanked all the speakers who had taken part in it. With regard to Dr. Northcroft's views on the nomenclature which should be used, he had found considerable difficulty in adapting two points of view. There was the official nomenclature of the Society, and there was the nomenclature

which was used in the anatomical world at the present moment. With reference to interstitial growth of the mandible, that could take place and was recognised by a large number of endocrinologists. Mr. Watkin had said that the spacing of the front teeth was due to a bad method of swallowing, and Mr. Russell Marsh thought it was due to an abnormally large tongue. In cretins there was an abnormally large tongue, but the cases in which one saw excessive spacing of the teeth were relatively rare. He thought it was due not to largeness of the tongue, but to the mobility and power behind it. He wished to thank Mr. Pitts very much for his criticism. Mr. Chapman had mentioned the fact that it was difficult to make a diagnosis from the slides, and he was quite in agreement with him on that matter. With regard to extractions, he thought Mr. Cutler had already replied to Mr. Chapman's remarks. Mrs. Lindsay had asked whether there was any respiratory obstruction in the cases he had shown with a distinctly rounded angle. The three cases in question had been examined in the children's department of the hospital before he had written his Communication, and all of them had been passed as fit, so there was no abnormality either with regard to the rest of the bones in the body. X-ray photographs of the head had been taken in every case, and they were all shown to be perfectly normal. He believed that Mr. Pitts had had a number of cases X-rayed to see if the pituitary gland was enlarged at all. Personally he was under the impression that it was not necessary for a gland to be enlarged to be malfunctioning, so in such cases one would not necessarily find an enlarged pituitary gland. Mr. Bull had answered the question asked by Mr. Endicott. Mr. Russell Marsh had stated that the appearance of one of the radiographs that he had shown—he thought it was the third one—was a perfectly normal condition. As he had not sufficient experience himself, he had asked the opinion of one or two other people on the question. He had asked the dental radiologist at his hospital whether he considered that the condition was abnormal, and, in comparison with many other X-rays that he had, the dental radiologist definitely came to the conclusion that in that one case it was an abnormal condition. The second point raised by Mr. Russell Marsh was that the spacing was not shown. At the age of two years the boy had a perfectly normal lower jaw, but the spacing became excessive later on. When the teeth were extracted the case became a true Class III case, as shown by the spacing which existed between the erupted first molar and the unerupted second molar. In the other slides of the X-rays that he had, it would be seen that the second molar was close up to the first molar and there was no space between those two teeth; their crypts were touching one another. A space between the periodontal membrane of the first molar and the crypt of the second premolar was abnormal.

SOME PROBLEMS IN STAINLESS STEEL TECHNIQUE.*

By Norman Gray, H.D.D.,R.C.S.Edin., L.D.S.Liv.

The many advantages of stainless steel for orthodontic purposes have turned all our thoughts in this direction, but the problems of soldering and welding are holding many back. There are plenty of difficulties. I have tried to distinguish between real difficulties and the result of carelessness, because it is in this latter category that a good many of my problems have occurred.

The problems crop up in plenty because it is a new field, and one has to learn the new technique pretty thoroughly. One immediate difficulty is to adapt old attachments to the new material. Indeed, when asked to give this Communication last year, I thought at once

* Read before the British Society for the Study of Orthodontics, Oct., 1935.

in terms of locking devices for the bands and arches, the attachment for the buccal tubes, etc., but the demonstrators at our last gathering, and at the European Orthodontic Congress, have thought out effective substitutes for most of these. For example, one problem was a good rigid lingual lock to replace the D tubes of the Mershon technique. McKeag has done that. Similarly, the strapping of the buccal tube to the anchor band was bulky or insecure compared with the soldered tube, but the new Watkin Roll tube is almost equal to the gold one. I have two or three models on show in case some have not seen them yet.

The difficulties fall into two natural divisions :

(1) Material.
(2) The Welder and Welding.

With regard to the material. We have learned to use the gold and platinum group very easily. We know its limitations, and so broken appliances have become less and less frequent. Stainless steel will not respond to the same methods, thus we have the mental fatigue of thinking out a new technique, and we are rewarded with a fresh crop of new appliances newly broken.

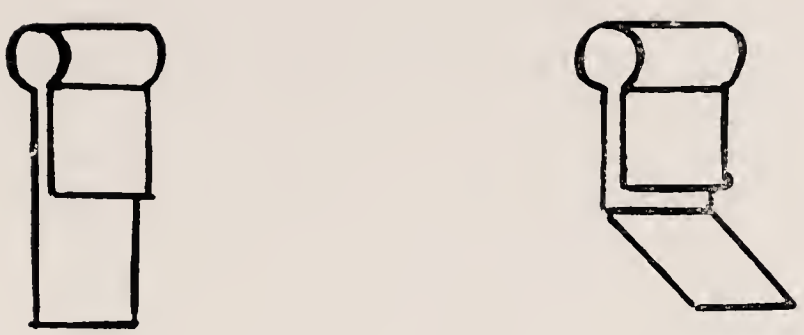
Gold and platinum can be heat-treated and made passive on the model—a most useful property. Stainless steel must be worked with the fingers and pliers.

Broken gold arches can be resoldered in the surgery in a few minutes. Stainless steel generally requires a new arch. That is all one can say against stainless steel. We all know its good properties, toughness, strength, cleanliness and cost.

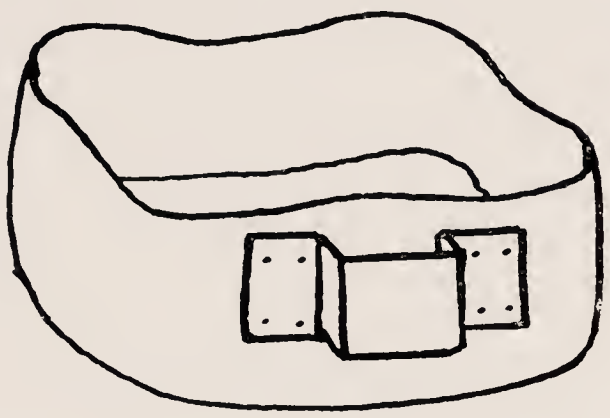
With regard to the second division : one's first problem is choice of apparatus, and I can do little to help your choice. Among the many prominent exponents there are two British pioneers whose opinion we all value enormously—Friel and Watkin. Each makes welding appear simpler than it really is. Each uses a different machine with unfailing success, and one's first problem is to decide which to follow. In my case about seventeen years have slipped by since Mr. Watkin first began to solve my electrical difficulties as well as my orthodontic problems, so that it was only natural I should turn to him in my dilemma. I did not turn in vain because he freely gave me of his valuable time, but I tremble to think how long it would have been taken by correspondence course. The Watkin welder was only just on the market (June, 1934), and ours arrived rather dismembered with very few instructions. As each of my colleagues joined me in experimenting with the adjustments, it made our earliest welds erratic beyond words. Once the machine is properly set up and adjusted it is chiefly the human element that is erratic. Have it near the surgery in the best possible light plus a good shaded light, as welding is very trying for the eyes.

A large proportion of difficulties occur through the electrodes. The pressure of these can be regulated, and once set is best left alone. The electrodes themselves must meet positively and definitely, and must be absolutely free from oxidation for each weld, also the arches free from mouth secretions. The grooves for holding the wires must be cut accurately and kept in good repair. It is a good idea continually to watch the upper one with a mouth mirror.

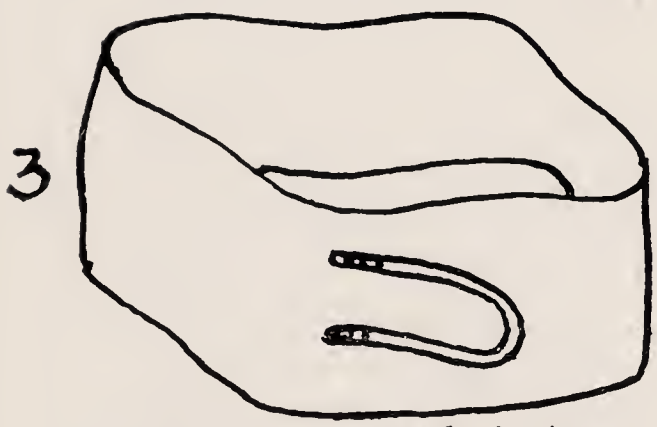
One must know something of the theory of the electrical conditions of welding. Many of my faulty welds were due to this lack of knowledge. Fortunately this knowledge is not complicated and is very readily obtained by reading and re-reading Dr. Friel's article



1.)
) McKeag Lock
2.)

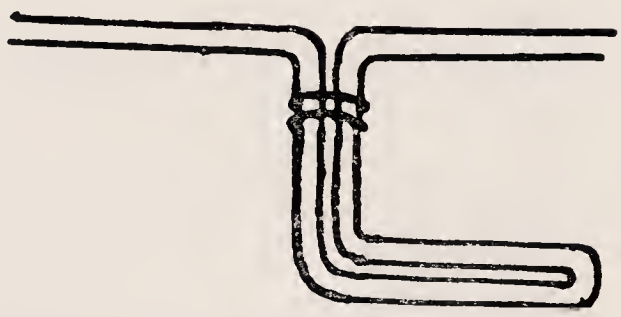


2.



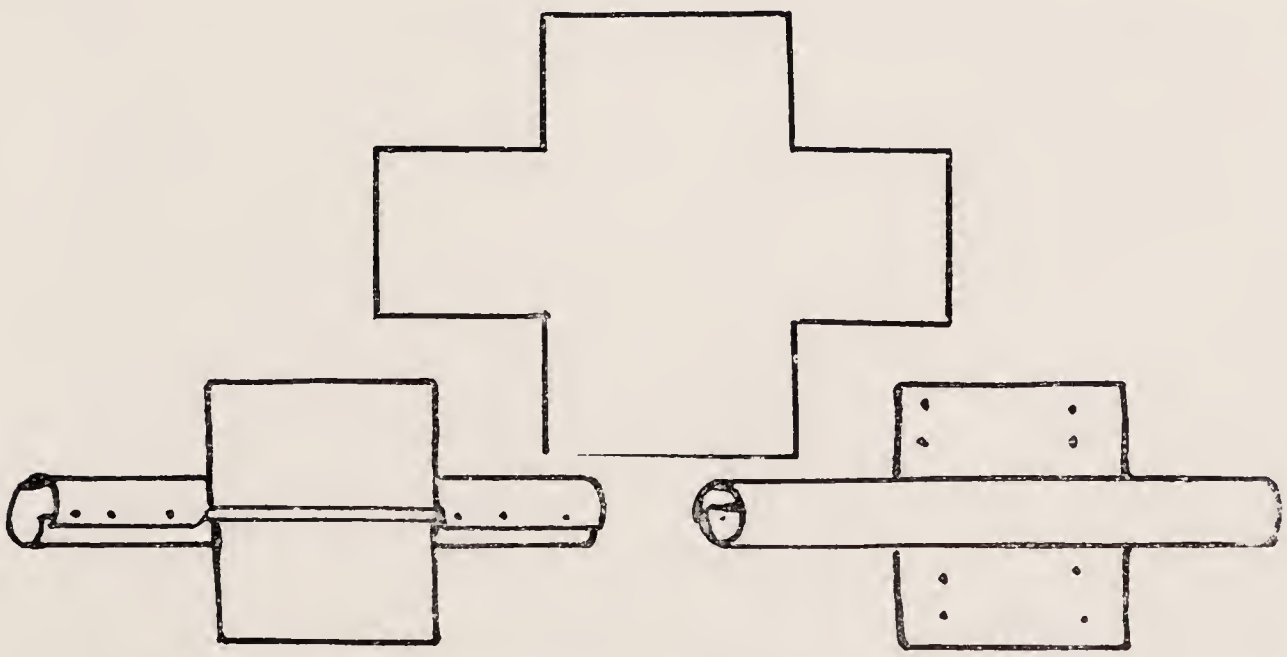
3

Doubly secured inter-maxillary hook.



4

Continuous inter-maxillary hook on Labial Arch.



5 Watkin rolled buccal tube.

on welding in the *Transactions* of this Society in 1933. It is easily the most detailed and lucid article on the subject and mentions nearly all the difficulties one meets.

Welding requires a current of heavy amperage (500-750 amps.) with comparatively low voltage (2 volts). It requires electrodes of extremely high conductivity, and a welding material of low conductivity, which stainless steel has. The orthodontic wires make such a very minute contact point at their join compared with the area of the electrodes that the heat at this point is correspondingly intense, and so a sudden fuse occurs. For a successful weld the current must only be allowed to flow for a fractional part of a second, just sufficient time to allow surface fusing without deforming the wire. "The maximum current for the minimum time," is a good working rule. The problem here is to gauge the speed of contact required for thick wires and thin wires. In welding combinations of thick and thin wire a further problem is present. Other factors being equal, a thin wire will obviously melt and deform before the thick wire has reached welding temperature. To overcome this difficulty, the thick wire must have an electrode with the smallest area of contact so that the current is concentrated in the smallest possible path, and the thin wire a proportionately large area to reduce the resistance and lengthen the time of heating.

I believe the new machines are now fitted with automatic switches, and the whole thing is worked out in tables, but there is so little repetition in orthodontic welding, and so many variable factors, that one must not take chances, and so if I have any doubt I always snip off two pieces of wire of the same gauge, and do trial welds until I get the correct fuse several times.

Finally, remember it is always well to test the machine in this way before using it.

Discussion.

Mr. H. G. Watkin said that he thought Mr. Gray's early troubles had been caused to a great extent by the fact that the welder was not turned out in a properly tested condition. An improvement had now been made in that respect. The automatic switch had removed much of the difficulty previously experienced. With reference to Mr. Gray's statement that he always made a test before carrying out the actual work, that was quite unnecessary. In radiography one did not try an exposure on the plate before taking the actual picture, and it was equally unnecessary to make a test with a welder which could be set to go at a definite time, with a definite power, definite pressure and definite electrodes. With regard to cleaning the electrodes, if they became oxidised it was a sign that too much current had been used, and they had got dirty because of ill usage. He could guarantee to use a machine for six months before the electrodes required truing up and cleaning. A special copper alloy, which was not easily oxidised, was now used for making the electrodes. It was very important in welding to have the correct time, the correct current, the correct pressure and the correct electrodes.

Mr. W. A. Bulleid said he was not quite clear whether Mr. Gray wanted to be able to solder stainless steel or not. It was no more difficult to solder than any other material. It was only necessary to use an appropriate flux, which could be obtained from Messrs. Firth, and either gold or silver could be used for the solder. Silver was the simpler : it was cheap, effective, and lasted well. Mr. Gray had spoken of the welding of thick wire to thin wire. In that case there was a risk of cutting through the thin wire, even with the appropriate pressure and the larger electrode, but a good plan was to cut a very fine groove in the nether electrode, into which the thin wire would rest for about two-thirds of its diameter, and then to lay the heavier wire over that. That protected the thin wire from the risk of being cut through.

Mr. N. Gray replied briefly.

A meeting of the Society was held at Manson House, 26, Portland Place, W.1, on Monday evening, January 14th, 1935. The President, Mr. A. L. Packham, M.R.C.S., L.R.C.P., L.D.S., occupied the chair. The following new members were introduced to the President: Mr. Lilley and Mr. R. W. Tuck.

Mr. J. H. Hovell, L.D.S.,R.C.S.Eng., was then called upon to read his short Communication, entitled "Some Cases of Inherited Dental Abnormalities."

In the name of the Society, the President thanked Mr. Hovell for his short Communication and also thanked the speakers who had taken part in the discussion of it.

A meeting of the Society was held at Manson House, 26, Portland Place, W.1, on Monday evening, February 4th, 1935. The President, Mr. A. L. Packham, occupied the chair.

The minutes of the last meeting, held on Monday, January 14th, 1935, were read and confirmed.

Mr. C. H. Kemball, a new member, was welcomed by the President.

The President announced the death of a former member of the Society, Mr. Montague Philpots, who had resigned his membership last year on account of ill-health. (The members stood in silence.)

The following candidate for membership was duly elected: Mr. D. P. Walther, L.D.S.Eng., 14, Buckland Crescent, Hampstead, N.W.3.

The President welcomed the visitors present and asked them to consider themselves members for the evening and to take part in any discussion that might take place.

Dr. Northcroft read a paper, "A short Communication on a Proposed Framework for the Arrangement of a Collection of Examples of Abnormalities in the Positions of Teeth."

Mrs. E. M. Johnson read a paper, "An Unusual Case of Apparent Prenormal Occlusion."

A meeting of the Society was held at Manson House, 26, Portland Place, W.1, on Monday evening, March 4th, 1935. The President, Mr. A. L. Packham, occupied the chair.

The minutes of the previous meeting having been read and confirmed, Mr. D. P. Walther, a newly-elected member, was introduced to the President and welcomed by him.

The President extended a hearty welcome to the visitors present and asked them to consider themselves members for the evening and to take part in any discussion that might arise should they wish to do so. He particularly welcomed the following visitors: Dr. S. Waldenstrom, Dr. Florath and Dr. Selmer-Olsen.

Dr. Selmer-Olsen thanked the Society for allowing him to attend the meeting. The President and members of the Norwegian Dental Society wished him to convey to the members of the British Society for the Study of Orthodontics their fraternal greetings and their best wishes for the success of the British Society.

The President said he was sure the members would wish Dr. Selmer-Olsen to convey their very hearty greetings to their confrères in Norway.

Short Communication.

Miss L. M. Clinch read the following short Communication: "The Orthodontic Treatment of Some Cases of Cleft Palate."

The President, next calling upon Professor Lundström to read

his paper, said that some little time ago the Society had had very great pleasure in asking Professor Lundström to accept honorary membership of the Society. About six or seven years ago, when the Society was housed in Chandos Street, Professor Lundström had read a most interesting paper before it.

Professor LUNDSTRÖM conveyed greetings to the Society from the Dental Society of Sweden. That Society would be seventy-five years old next autumn, and sent its greetings to the British Society, which it regarded as its younger brother. He also thanked the Society for the honour it had conferred upon him in electing him an honorary member and for asking him to read his paper before it.

The following paper was then read : " Some Evidence Concerning the Nature of Bi-maxillary Crowding."

A paper was read by Mr. H. T. A. McKEAG, " The Design of Orthodontic Appliances."

A demonstration meeting was held on May 6th.

A meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, October 7th, 1935, at 8 p.m. The President, Mr. A. L. PACKHAM, occupied the chair.

The following candidate was duly elected a member of the Society : Mr. C. BOWDLER HENRY, M.R.C.S., L.R.C.P., L.D.S., 62, Harley Street, W.1.

The following short Communication was then read by Mr. N. GRAY : " Some Problems in Stainless Steel Technique."

The PRESIDENT said the subject with which Mr. Gray had dealt was well to the fore at the present moment.

An ordinary meeting of the Society was held at Manson House, Portland Place, W.1, on Monday evening, November 4th, 1935. The President, Mr. A. L. PACKHAM, occupied the chair.

The PRESIDENT referred to the sad death of Mr. George James Goldie. (The members stood in silence.)

The following two candidates for election were duly elected as members of the Society : Mr. D. S. WIGGINTON, L.D.S.Eng., 62, Upper Tulse Hill, S.W.2, and Mr. W. G. CARNEGIE DICKSON, L.D.S.Eng., 7, Upper Harley Street, N.W.1.

A paper was given by Mrs. LINDSAY, " A Review of Orthodontic Literature of the Past Year."

Mr. R. O. BARBER read a paper, " Prenormal Occlusion, True and Apparent."

The annual general meeting for the year 1935 was held at Manson House, 26, Portland Place, W.1, on Monday, December 2nd, 1935, at 8 p.m. The retiring President, Mr. A. L. PACKHAM, occupied the chair.

The PRESIDENT referred to the death of Mr. HERBERT C. MALLESON, an old and valued member of the Society, who had been Senior Dental Surgeon to Guy's Hospital. Mr. Malleson had made valuable contributions to dental science as a whole, and his death was a very great loss to the profession which he adorned and to the Society. He felt sure that the members would wish the Secretary to write to Mrs. Malleson, the widow, offering her their deep sympathy in the great loss which she had sustained. (The members stood in silence.)

The following candidate was duly elected a member of the Society : Mr. E. R. COOPER, L.D.S.Edin., 18, Victoria Square, Newcastle-on-Tyne.

The following newly elected members signed the Obligation Book and were admitted to membership of the Society: Mr. Carnegie Dickson and Mr. R. Ballard.

No private nominations having been received, the President declared that the following members, who had been nominated by the Council, would be the officers and councillors for the year 1936:—

President, Mr. F. Bocquet Bull; Immediate Past-President, Mr. A. L. Packham; Vice-Presidents, Mr. F. St. J. Steadman, Mrs. L. Lindsay and Mr. H. C. Visick; Secretary, Mr. R. Cutler; Treasurer, Mr. H. R. Evans; Curator, Mr. Russell Marsh; Librarian, Miss K. C. Smyth; Editor, Mr. M. A. Rushton; Councillors, Mr. N. Gray, Mr. H. Chapman and Mr. S. A. Riddett.

The following members were elected Auditors of the Society for the year 1936: Mr. J. A. Hudson (proposed by Mr. Chapman, seconded by Mrs. Lindsay), and Mr. S. Southwood (proposed by Mrs. Lindsay, seconded by Mr. Chapman).

Case reports were given by Mr. Harold Chapman, Mr. H. G. Watkin, Mr. J. Sturrock and Mr. L. Russell Marsh.

Hon. Treasurer's Report.

During the past year the amount received from subscriptions has been £273 1*s.* 9*d.*, which is £7 13*s.* 6*d.* less than the previous year. The expenditure for 1935 has amounted to £219 3*s.* 8*d.*; this leaves a credit balance of £53 18*s.* 1*d.* on the year's working. In February £180 was transferred from the deposit account and a sum of £70 added from the current account, making a total of £250, which was invested in $2\frac{1}{2}$ per cent. Consolidated Stock. This was purchased at $90\frac{3}{8}$. The Society's assets are as follows: 500 National Savings Certificates at a present value of £560 16*s.* 8*d.*; $2\frac{1}{2}$ per cent. Consolidated Stock, purchase value £250; cash on deposit, £10; cash at bank and in hand, £116 3*s.* 9*d.*; making a total of £937 0*s.* 5*d.*, as against £844 7*s.* $3\frac{1}{2}$*d.* last year.

Mr. G. C. Friend said he did not think the Society needed a balance of £937, and he considered that something should be done with the money. (*Applause.*) He could not make any suggestion in that respect at the moment, as he had not had time to think the matter over.

Mr. H. C. Visick thought that, in view of the large balance, the subscription might be reduced.

Dr. G. Northcroft suggested that the Council should go into the matter and see how they could wisely use the money, which was really lying idle and was of no use to anyone at present. The subject could not be dealt with at a full meeting of the Society.

The President said the matter was exercising the minds of the Council at the present moment, and he was sure the Council would bear in mind Mr. Visick's suggestion and any other suggestions that might be made by the members.

Mr. Bull suggested that, as an Empire Meeting of the British Dental Association was to be held next year, the Society might spend a little of its money in hospitality, by giving a dinner or holding a function of some kind.

On the proposition of Mrs. L. Lindsay, seconded by Mr. F. St. J. Steadman, the report of the Treasurer was adopted.

Hon. Secretary's Report.

The Hon. Secretary (Mr. R. Cutler) read the following report:—

A review of the past shows that the Society continues to make

that evening. There were many problems before the Council, and he was sure that the Council had the goodwill of all the members of the Society. That being so, he had no doubt that the Society would go from strength to strength.

Mr. A. L. Packham then vacated the chair and invested the new President, Mr. F. Bocquet Bull, with the badge of office.

Mr. Bocquet Bull took the chair amid applause, and thanked the members for the honour that had been conferred upon him. He would have a further opportunity of thanking them when he delivered his presidential address at the next meeting of the Society.

The meeting then terminated.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

INCOME AND EXPENDITURE ACCOUNT FOR 1936.

Receipts.	1933-34. £ s. d.	1934-35. £ s. d.
By Members' Subscriptions	281 15 5	273 1 7
,, Deposit Interest	0 19 7	0 7 8
,, Interest on Consolidated Stock ...	—	5 3 6
		278 12 9
,, Transfer from Deposit Account...	—	180 0 0
		458 12 9
,, Debit Balance	—	10 10 11
	£282 15 0	£469 3 8

Payments.	1933-34. £ s. d.	1934-35. £ s. d.
To Rent	50 0 0	50 0 0
,, Printing and Transactions ...	66 11 6	68 15 6
,, Reporting	18 18 0	18 18 0
,, Refunded Subscriptions	0 10 6	3 3 0
,, Refreshments	22 1 0	21 15 0
,, Honorarium—Mr. Yarrow ...	—	26 5 0
,, Hire of Electric Standards & Tables	3 17 0	4 18 0
,, Petty Cash	15 0 0	14 10 0
,, Bank Debits	0 0 2	0 8 8
,, Insurance on Books and Badges ...	0 15 0	0 15 0
,, Legal Charges in respect of Lease	6 5 6	—
,, Photographs of Models (demonstration)	6 0 0	—
,, Lantern Slides	—	7 6 0
,, Income Tax	3 7 3	0 12 0
,, Lantern Attendant	—	1 17 6
,, Purchase of Consolidated Stock ...	—	250 0 0
	193 5 11	469 3 8
,, Balance	89 9 1	—
	£282 15 0	£469 3 8

Assets.			£ s. d.
500 National Savings Certificates (present value) ...			560 16 8
2½ per cent. Consolidated Stock (purchase value) ...			250 0 0
Deposit at Bank			10 0 0
Cash at Bank			103 13 5
Cash in hand : Secretary	£4 18 2		
Librarian	4 10 5½		
Editor	0 16 0½		
Treasurer	2 5 8		
			12 10 4
Total ...			£937 0 5

We have examined the Books and Vouchers and certify the above Statement of Accounts to be correct.

(Signed) Leslie W. Boness.
James A. Hudson.

November 27th, 1935.